Missouri

Missouri's Recommendation for Area Boundary Designations for the 2012 Annual Fine Particulate Matter National Ambient Air Quality Standard

Missouri Air Conservation Commission
Adoption
December 5th, 2013

Missouri Department of Natural Resources
Division of Environmental Quality
Air Pollution Control Program
P.O. Box 176
Jefferson City, MO 65102
Telephone (573) 751-4817

TABLE OF CONTENTS

<u>List of Tables</u>

List of Figures

List of Appendices

FINE PARTICLE BOUNDARY RECOMMENDATION

Introduction and Purpose

On December 14, 2012, EPA promulgated $PM_{2.5}$ air quality standards (78 FR 3036). These standards were based on a number of health studies showing that increased exposure to $PM_{2.5}$ is correlated with increased mortality and a range of serious health effects, including aggravation of lung disease, asthma attacks, and heart problems. EPA established a new primary standard for $PM_{2.5}$. The standard is based on an annual average and was set at a level of 12.0 micrograms per cubic meter. Under the same action, EPA retained the existing secondary annual standard for $PM_{2.5}$, the existing primary and secondary 24-hour standards for $PM_{2.5}$, as well as the existing primary and secondary standards for particulate matter with aerodynamic diameters of 10 microns or less (PM_{10}).

Whenever a NAAQS is revised, the designation process is the first step in addressing this public health issue. Section 107(d)(1) of the Clean Air Act requires each state to recommend attainment/unclassifiable and nonattainment areas including appropriate boundaries within one year after a NAAQS is established. EPA can then accept the recommendations or make modifications, as it deems necessary. Section 107(d)(1)(A) of the Clean Air Act defines a nonattainment area as any area that does not meet or that contributes to nearby areas not meeting the ambient air quality standard. All other areas should be classified as attainment/unclassifiable.

The deadline for submittal of Missouri's boundary designation recommendations for the 2012 Annual $PM_{2.5}$ NAAQS is December 13, 2013. By August 14, 2014, EPA is to notify Missouri concerning any modifications to the recommendation, and allow for comments to those changes. If Missouri has comments regarding EPA modifications to the state recommendation, they will need to be submitted by October 29, 2014. The deadline for EPA to finalize the boundary designations is December 12, 2014.

Upon designation, states have 18 months to prepare State Implementation Plans (SIPs) to address $PM_{2.5}$ nonattainment areas. EPA intends to publish an implementation rule shortly after designations are finalized that will establish requirements for $PM_{2.5}$ nonattainment areas. The deadline for attaining the $PM_{2.5}$ standard is as expeditiously as practicable, but not later than the end of the sixth calendar year after the area is designated nonattainment. Depending on the timing of when the final designations become effective, the attainment deadline for areas designated nonattainment of the 2012 Annual $PM_{2.5}$ NAAQS could be the end of the calendar year in 2020 or 2021.

The purpose of this document is to summarize the analysis of the National Ambient Air Quality Standard (NAAQS) for fine particulate ($PM_{2.5}$) in Missouri to support a recommendation to EPA for designation of geographic areas in the state for the 2012 Annual $PM_{2.5}$ NAAQS. In general, the analysis is based on information collected from the years 2010 - 2012 and the U.S. Environmental Protection Agency (EPA) Guidance for Area Designations for the 2012 Annual $PM_{2.5}$ NAAQS: http://www.epa.gov/pmdesignations/2012standards/docs/april2013guidance.pdf

Summary of Recommendation

Based on the weight of evidence evaluation performed by the Air Program with consideration of EPA guidance, the State of Missouri recommends each county in the State for designation as attainment/unclassifiable under the 2012 Annual $PM_{2.5}$ NAAQS. These county-by-county designation recommendations are listed in Table 1.

Table 1 Missouri Classification Recommendations for the 2012 Annual $PM_{2.5}$ NAAQS

County	Classification Recommendation
ADAIR	Attainment/Unclassifiable
ANDREW	Attainment/Unclassifiable
ATCHISON	Attainment/Unclassifiable
AUDRAIN	Attainment/Unclassifiable
BARRY	Attainment/Unclassifiable
BARTON	Attainment/Unclassifiable
BATES	Attainment/Unclassifiable
BENTON	Attainment/Unclassifiable
BOLLINGER	Attainment/Unclassifiable
BOONE	Attainment/Unclassifiable
BUCHANAN	Attainment/Unclassifiable
BUTLER	Attainment/Unclassifiable
CALDWELL	Attainment/Unclassifiable
CALLAWAY	Attainment/Unclassifiable
CAMDEN	Attainment/Unclassifiable
CAPE GIRARDEAU	Attainment/Unclassifiable
CARROLL	Attainment/Unclassifiable
CARTER	Attainment/Unclassifiable
CASS	Attainment/Unclassifiable
CEDAR	Attainment/Unclassifiable
CHARITON	Attainment/Unclassifiable
CHRISTIAN	Attainment/Unclassifiable
CLARK	Attainment/Unclassifiable
CLAY	Attainment/Unclassifiable
CLINTON	Attainment/Unclassifiable
COLE	Attainment/Unclassifiable
COOPER	Attainment/Unclassifiable
CRAWFORD	Attainment/Unclassifiable
DADE	Attainment/Unclassifiable
DALLAS	Attainment/Unclassifiable
DAVIESS	Attainment/Unclassifiable
DeKALB	Attainment/Unclassifiable
DENT	Attainment/Unclassifiable
DOUGLAS	Attainment/Unclassifiable
DUNKLIN	Attainment/Unclassifiable
FRANKLIN	Attainment/Unclassifiable
GASCONADE	Attainment/Unclassifiable
GENTRY	Attainment/Unclassifiable
GREENE	Attainment/Unclassifiable
GRUNDY	Attainment/Unclassifiable
HARRISON	Attainment/Unclassifiable
HENRY	Attainment/Unclassifiable
HICKORY	Attainment/Unclassifiable
HOLT	Attainment/Unclassifiable

County	Classification Recommendation
HOWARD	Attainment/Unclassifiable
HOWELL	Attainment/Unclassifiable
IRON	Attainment/Unclassifiable
JACKSON	Attainment/Unclassifiable
JASPER	Attainment/Unclassifiable
JEFFERSON	Attainment/Unclassifiable
JOHNSON	Attainment/Unclassifiable
KNOX	Attainment/Unclassifiable
LACLEDE	Attainment/Unclassifiable
LAFAYETTE	Attainment/Unclassifiable
LAWRENCE	Attainment/Unclassifiable
LEWIS	Attainment/Unclassifiable
LINCOLN	Attainment/Unclassifiable
LINN	Attainment/Unclassifiable
LIVINGSTON	Attainment/Unclassifiable
McDONALD	Attainment/Unclassifiable
MACON	Attainment/Unclassifiable
MADISON	Attainment/Unclassifiable
MARIES	Attainment/Unclassifiable
MARION	Attainment/Unclassifiable
MERCER	Attainment/Unclassifiable
MILLER	Attainment/Unclassifiable
MISSISSIPPI	Attainment/Unclassifiable
MONITEAU	Attainment/Unclassifiable
MONROE	Attainment/Unclassifiable
MONTGOMERY	Attainment/Unclassifiable
MORGAN	Attainment/Unclassifiable
NEW MADRID	Attainment/Unclassifiable
NEWTON	Attainment/Unclassifiable
NODAWAY	Attainment/Unclassifiable
OREGON	Attainment/Unclassifiable
OSAGE	Attainment/Unclassifiable
OZARK	Attainment/Unclassifiable
PEMISCOT	Attainment/Unclassifiable
PERRY	Attainment/Unclassifiable
PETTIS	Attainment/Unclassifiable
PHELPS	Attainment/Unclassifiable
PIKE	Attainment/Unclassifiable
PLATTE	Attainment/Unclassifiable
POLK	Attainment/Unclassifiable
PULASKI	Attainment/Unclassifiable
PUTNAM	Attainment/Unclassifiable
RALLS	Attainment/Unclassifiable
RANDOLPH	Attainment/Unclassifiable
RAY	Attainment/Unclassifiable
REYNOLDS	Attainment/Unclassifiable
RIPLEY	Attainment/Unclassifiable
ST. CHARLES	Attainment/Unclassifiable
ST. CLAIR	Attainment/Unclassifiable
ST. FRANCOIS	Attainment/Unclassifiable
STE. GENEVIEVE	Attainment/Unclassifiable
ST. LOUIS COUNTY	Attainment/Unclassifiable
SALINE	Attainment/Unclassifiable
SCHUYLER	Attainment/Unclassifiable

County	Classification Recommendation
SCOTLAND	Attainment/Unclassifiable
SCOTT	Attainment/Unclassifiable
SHANNON	Attainment/Unclassifiable
SHELBY	Attainment/Unclassifiable
STODDARD	Attainment/Unclassifiable
STONE	Attainment/Unclassifiable
SULLIVAN	Attainment/Unclassifiable
TANEY	Attainment/Unclassifiable
TEXAS	Attainment/Unclassifiable
VERNON	Attainment/Unclassifiable
WARREN	Attainment/Unclassifiable
WASHINGTON	Attainment/Unclassifiable
WAYNE	Attainment/Unclassifiable
WEBSTER	Attainment/Unclassifiable
WORTH	Attainment/Unclassifiable
ST. LOUIS CITY	Attainment/Unclassifiable

Background

$PM_{2.5}$ is generally emitted from activities such as industrial and residential combustion and from vehicle exhaust. Fine particles are also formed in the atmosphere when gases such as sulfur dioxide, nitrogen oxides, and volatile organic compounds; also emitted largely by combustion activities, are chemically transformed in the atmosphere into particles.

The annual $PM_{2.5}$ NAAQS was originally established in 1997, and had not been revised until now. During the designation process for the 1997 standard, monitors in St. Louis on both the Illinois and Missouri sides were violating the standard and the final nonattainment area consisted of the City of St. Louis and the Counties of Franklin, Jefferson, St. Louis, and St. Charles on the Missouri side as well as the Baldwin Township in Randolph County and the Counties of Monroe, St. Clair, and Madison on the Illinois side. Since then, numerous state and federal control strategies have been implemented in the St. Louis area and around the country that have resulted in improvement in the monitored $PM_{2.5}$ concentrations observed in St. Louis.

On May 23, 2011, EPA published a final rule, known as a clean data determination, stating that the St. Louis $PM_{2.5}$ nonattainment area covering both Missouri and Illinois has attained the 1997 annual $PM_{2.5}$ standard based on three years of quality assured ambient air monitoring data (76 FR 29652). After this clean data determination was made, Missouri developed a maintenance plan and redesignation demonstration for the Missouri portion of the St. Louis $PM_{2.5}$ nonattainment area under the 1997 standard and submitted the plan to EPA in August 2011. A review of 2011 and 2012 ambient $PM_{2.5}$ monitoring data in the St. Louis area shows continued declining trends for annual $PM_{2.5}$ design values across the area demonstrating that ambient concentrations of $PM_{2.5}$ in St. Louis are improving at a steady pace as a result of controls that are already in place. It is anticipated that EPA will formally redesignate the area to attainment of the 1997 Annual $PM_{2.5}$ NAAQS sometime in 2014.

Criteria for Designation

EPA issued a guidance document through a memorandum titled “Initial Area Designations for the 2012 Revised Primary Annual Fine Particle National Ambient Air Quality Standard.” on April 16, 2013. This guidance was written to outline the information that states are expected to consider when making their nonattainment boundary recommendations. In that guidance, EPA directs states to first identify all violating monitors. After identifying each monitor or group of monitors that indicate a violation of the standard in an area, states should analyze counties in the entire metropolitan area (Core Based Statistical Area (CBSA) or Combined Statistical Area (CSA)) in which the violating monitor is located. States are also directed by EPA through this guidance to evaluate adjacent counties to the CBSA or CSA that have the potential to contribute. Although the CBSA or CSA is the starting point, the EPA does not intend it to be a presumed nonattainment area boundary, and that a weight of evidence approach should be made on a case by case basis to determine the appropriate nonattainment boundaries for each violating monitor or group of violating monitors.

As stated above, ambient $PM_{2.5}$ monitors in the counties of St. Clair and Madison in Illinois are violating the 2012 Annual $PM_{2.5}$ NAAQS based on 2010 – 2012 ambient air quality monitoring data. Therefore in evaluating these violations and the appropriate nonattainment boundaries,

Missouri has analyzed data from all counties included in the St. Louis Metropolitan Statistical Area (MSA) (City of St. Louis, and St. Louis, St. Charles, Franklin, Jefferson, Warren, and Lincoln Counties) as well as counties adjacent to the St. Louis MSA (Pike, Montgomery, Gasconade, Crawford, Washington, St. Francois, and Ste. Genevieve).

EPA's guidance recommends that states base their boundary recommendations on an evaluation of information relevant to five factors: air quality data, emissions and emissions-related data, meteorology, geography/topography, and jurisdictional boundaries. Missouri has developed a weight of evidence analysis for each of the violating monitors located in Illinois in the St. Louis MSA. Each of these analyses considers these five factors in an effort to determine the likelihood of whether Missouri sources are causing/contributing to the violations.

Public Participation

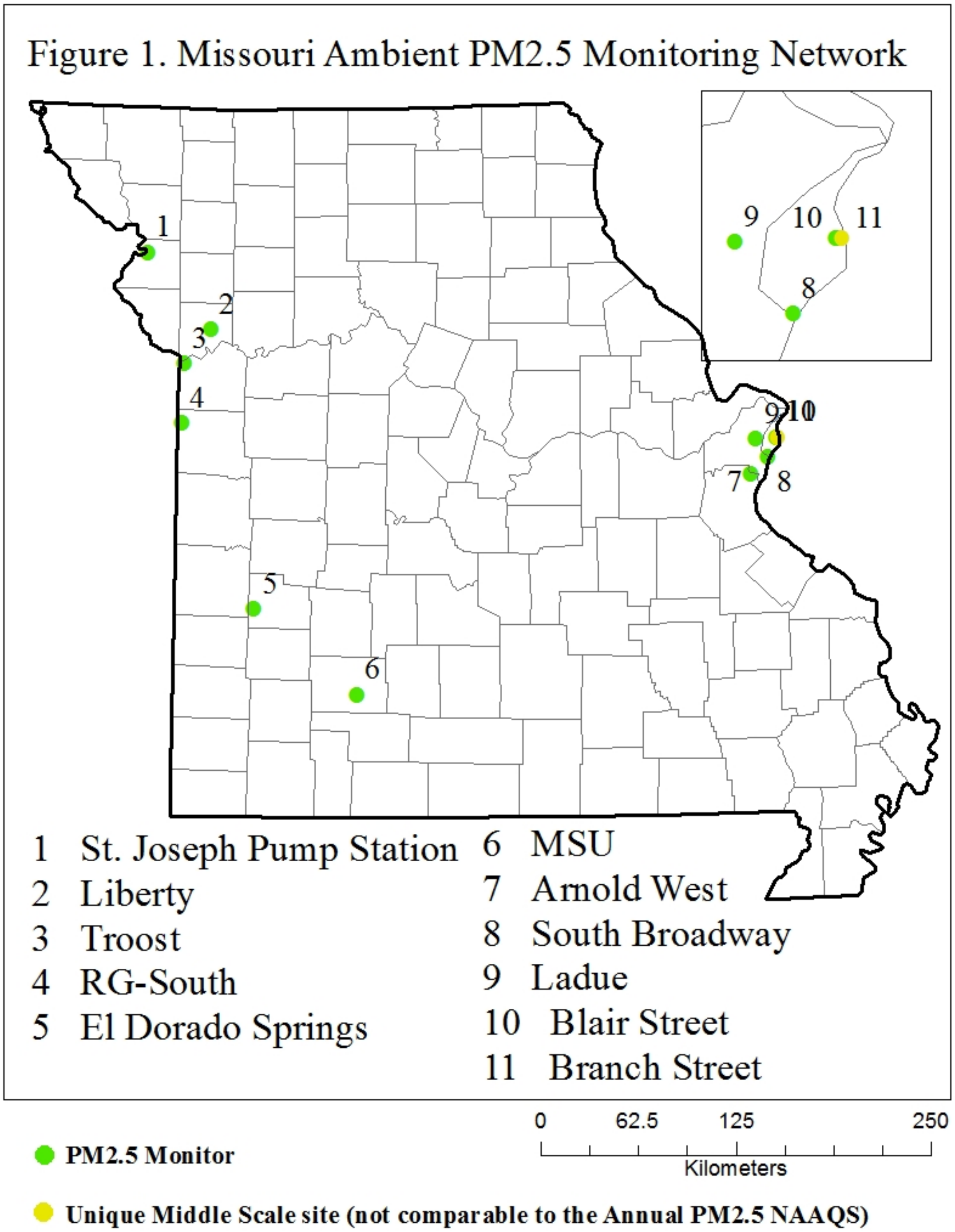
The department's Air Pollution Control Program developed this document and it was widely shared with stakeholders and with the Illinois Environmental Protection Agency. Multiple informational meetings were held with stakeholders to discuss the boundary designation process, the data sets that were used, and the analyses that Missouri performed throughout this process. The proposed boundary recommendation was posted online for public review and comment by October 1, 2013 at the following web address: http://www.dnr.mo.gov/env/apcp/stateplanrevisions.htm. A public hearing was held before the Missouri Air Conservation Commission on November 21, 2013. Comments regarding the proposed boundary recommendations were accepted through the close of business on November 29, 2013, which was seven (7) days after the public hearing.

Technical Considerations – Overview

This recommendation has been developed based on a review of the technical information as suggested by EPA guidance. Of primary consideration is a review of the ambient air quality monitoring data in all relevant Missouri counties and in all relevant counties in other states that border Missouri.

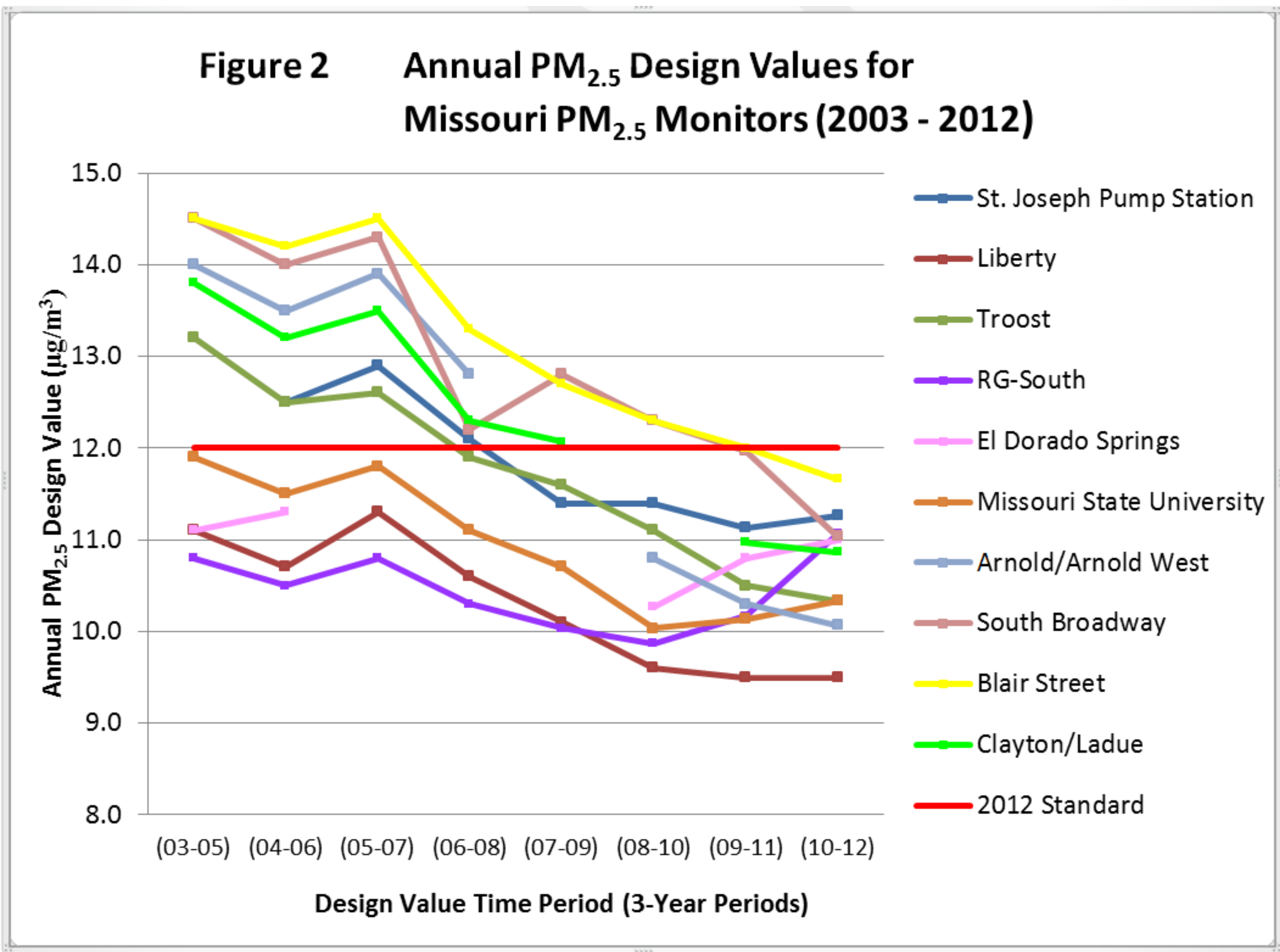
Figure 1 displays Missouri's $PM_{2.5}$ ambient air monitoring network and Table 2 displays the 2010 – 2012 design values for all ambient $PM_{2.5}$ monitors that are suitable for comparison to the annual $PM_{2.5}$ NAAQS. For the purposes of this document, only air quality monitoring data from monitors that are suitable for comparison to the annual $PM_{2.5}$ NAAQS are considered. As noted in Figure 1, the Branch Street monitor is a unique middle scale monitor that is not suitable for comparison to the annual $PM_{2.5}$ NAAQS, and is therefore not considered for analysis in this document. As seen in Table 2, there are no monitors in Missouri with annual $PM_{2.5}$ design values in violation of the 2012 Annual $PM_{2.5}$ NAAQS.

Figure 2 displays the annual $PM_{2.5}$ design values from 2003 – 2012 for all monitors in Missouri that are suitable for comparison to the annual $PM_{2.5}$ NAAQS. As seen in the figure, annual $PM_{2.5}$ concentrations in Missouri have steadily declined over the past ten years. The fact that all monitors in Missouri are complying with the 2012 Annual $PM_{2.5}$ NAAQS, and average annual $PM_{2.5}$ concentrations across the state show a continued improvement over the last decade and in recent years supports a designation of attainment/unclassifiable for all counties in the state.



Note: The Branch Street monitor is defined as a unique middle scale monitor and has been given a legacy exemption meaning it is not comparable to the 2012 Annual $PM_{2.5}$ NAAQS, per EPA's July 2013 Air Quality Design Value Review: http://www.epa.gov/ttn/analysis/dvreview.htm. This monitor is not representative of area-wide $PM_{2.5}$ concentrations as many of the episodes and trends recorded at the Branch Street monitor are unique to this location and not experienced across the St. Louis Region even by the neighborhood scale Blair Street monitor, which is less than 800 m from the Branch Street monitor location. Therefore, while trends and episodes at this monitor are useful and relevant for comparison and analysis of the 24-hour $PM_{2.5}$ NAAQS, the episodes and design values at this monitor are not suitable for comparison and analysis of the Annual $PM_{2.5}$ NAAQS. For additional details regarding the Branch Street monitor's status as a unique middle scale monitor, please see Appendix C.

Table 2 Missouri Ambient $PM_{2.5}$ Monitor Design Values (2010 – 2012)			
Site name	**AQS Site ID**	**County**	**2010 - 2012 Annual $PM_{2.5}$ Design Value**
St. Joseph Pump Station	29-021-0005	Buchanan	11.3
Liberty	29-047-0005	Clay	9.4
Troost	29-095-0034	Jackson	10.3
RG-South	29-037-0003	Cass	11.1
El Dorado Springs	29-039-0001	Cedar	11.0
Missouri State University	29-077-0032	Greene	10.3
Arnold West	29-099-0019	Jefferson	10.1
South Broadway	29-510-0007	St. Louis City	11.0
Blair Street	29-510-0085	St. Louis City	11.7
Ladue	29-189-3001	St. Louis County	10.9

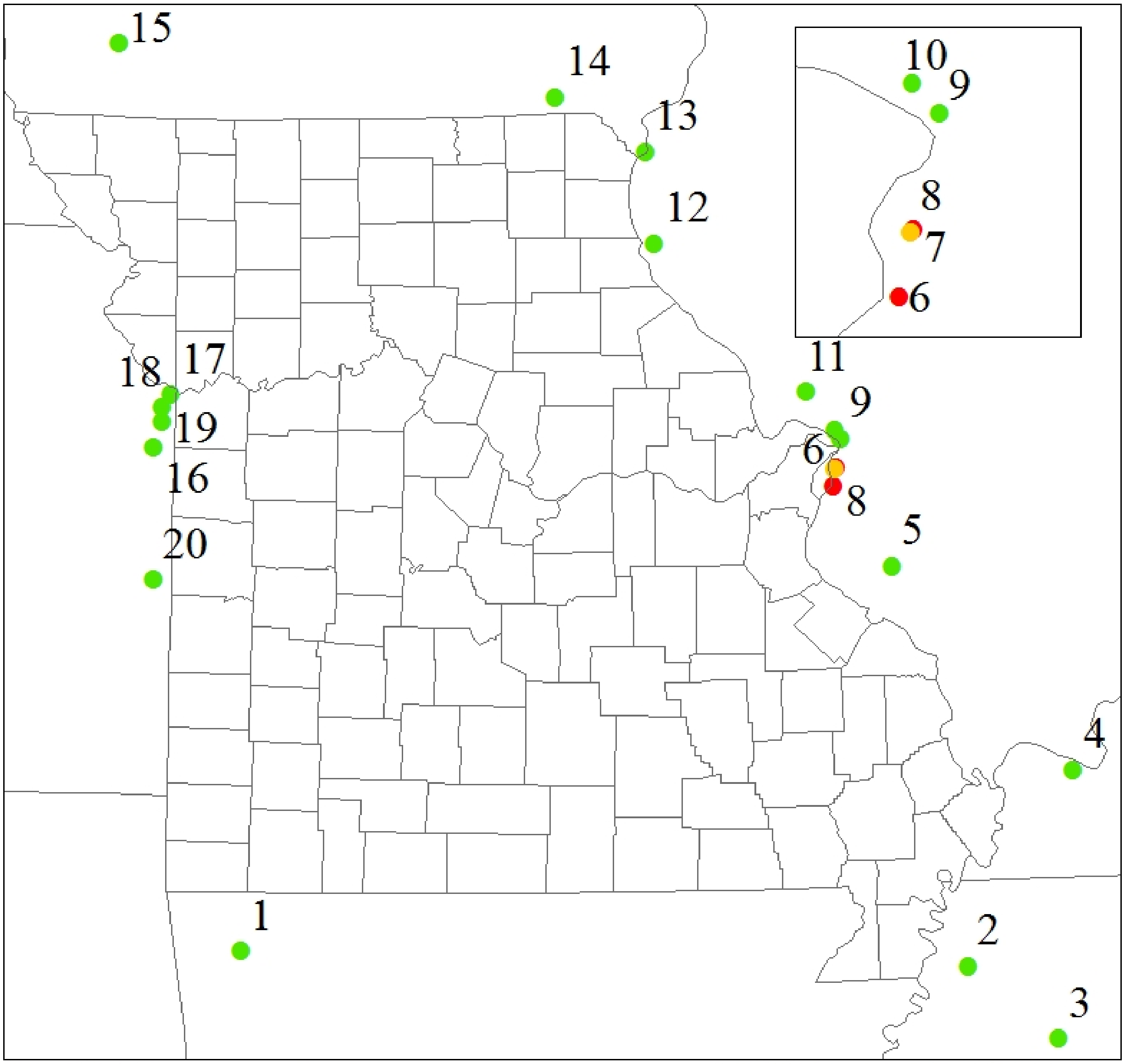


Per Section 107 of the Clean Air Act, areas should also be designated nonattainment if they are contributing to air pollutant concentrations in nearby areas that are out of compliance with the level of the NAAQS. The first step in determining if sources in Missouri are contributing to nearby areas outside Missouri that are violating the NAAQS is to determine if any other state has $PM_{2.5}$ monitors located near Missouri that are violating the 2012 standard. Figure 3 displays all $PM_{2.5}$ monitors outside Missouri but within 50 km from Missouri's border. Monitors listed in red are monitors that have 2010 – 2012 design values in violation of the 2012 Annual $PM_{2.5}$ NAAQS. Table 3, listed below, provides the 2010 – 2012 design values of each monitor included in Figure 3 that is suitable for comparison to the annual $PM_{2.5}$ NAAQS. As seen in Table 3 and Figure 3, there are two monitors located within 50 km of Missouri's border with 2010 – 2012 design values in violation of the 2012 Annual $PM_{2.5}$ NAAQS. These monitors include the IEPA RAPS Trailer site located in East St. Louis, Illinois (AQS Site ID: 17-163-0010) (hereinafter referred to as the East St. Louis monitor), and the Fire Station #1 site located in Granite City, Illinois (AQS Site ID: 17-119-1007) (hereinafter referred to as the Granite City monitor). These monitors are located in the Illinois counties of St. Clair and Madison, both of which border the Missouri portion of the St. Louis Metropolitan Statistical Area (MSA). A more thorough analysis of these violating monitors was performed to determine if there are nearby emissions sources in Missouri that are causing/contributing to these violations.

Table 3 $PM_{2.5}$ Design Values for Monitors Outside but Near Missouri (2010 – 2012)

Site name	AQS Site ID	State	County	2010 - 2012 Annual $PM_{2.5}$ Design Value
Springdale	05-143-0005	Arkansas	Washington	10.8
Dyersburg	47-045-0004	Tennessee	Dyer	9.4
Jackson	47-113-0006	Tennessee	Madison	9.4
Paducah	21-145-1004	Kentucky	McCracken	10.6
IEPA Trailer	17-157-0001	Illinois	Randolph	9.3
IEPA RAPS Trailer	17-163-0010	Illinois	St. Clair	12.2
Fire Station #1	17-119-1007	Illinois	Madison	13.5
Water Plant	17-119-3007	Illinois	Madison	11.6
SIU Dental Clinic	17-119-2009	Illinois	Madison	11.8
Illini Jr. High School	17-083-1001	Illinois	Jersey	10.0
John Wood Community College	17-001-0007	Illinois	Adams	10.2
Keokuk Fire Station	19-111-0008	Iowa	Lee	11.4
Lake Sugema State Park II	19-177-0006	Iowa	Van Buren	9.6
Viking Lake State Park	19-137-0002	Iowa	Montgomery	9.2
Heritage Park	20-091-0010	Kansas	Johnson	7.7
JFK	20-209-0021	Kansas	Wyandotte	10.2
Midland Trail Elementary School	20-209-0022	Kansas	Wyandotte	8.8
Justice Center	20-091-0007	Kansas	Johnson	9.0
Mine Creek	20-107-0002	Kansas	Linn	9.1

Figure 3. Ambient PM2.5 Monitors Outside But Near Missouri



1 Springdale
2 Dyersburg PM2.5
3 Jackson
4 Paducah
5 IEPA Trailer
6 IEPA RAPS Trailer
7 Fire Station #1
8 Gateway Regional Medical Center
9 Water Plant
10 SIU Dental Clinic11 Illini Jr. High
12 John Wood Community College
13 Keokuk Fire Station
14 Lake Sugema State Park II
15 Viking Lake State Park
16 Heritage Park
17 JFK
18 Midland Trail Elementary School
19 Justice Center
20 Mine Creek

PM2.5 Concentration

- > 12 ug/m^3
- < 12 ug/m^3
- Unique Middle Scale site (not comparable to Annual PM2.5 NAAQS)

Note: The Gateway Regional Medical Center monitor is defined as a unique middle scale monitor and has been given a legacy exemption meaning it is not comparable to the 2012 Annual $PM_{2.5}$ NAAQS, per EPA's July 2013 Air Quality Design Value Review: http://www.epa.gov/ttn/analysis/dvreview.htm.

Appendix A provides the evaluation performed for the Granite City monitor, and Appendix B provides the evaluation performed for the East St. Louis monitor. Both evaluations perform a weight of evidence analysis as described in the EPA Guidance on the Area Designations for the 2012 Annual $PM_{2.5}$ NAAQS taking into consideration the following five criteria: air quality data, emissions data, meteorology data, topography/geography, and jurisdictional boundaries. In addition to these five criteria, an evaluation of existing and planned future controls in the St. Louis area was performed to determine the potential for new additional control strategies on the Missouri side of the St. Louis MSA.

The evaluation of the Granite City monitor (Appendix A) supports a conclusion that Missouri does not contain nearby sources that are causing/contributing to the violation at this monitor. The evaluation concludes that the violation in Granite City is caused by a nearby source located in Granite City, Illinois. Based on the meteorological data evaluated, when winds are calm or are blowing from the south making the Granite City monitor downwind from the nearby Illinois source, this results in the highest $PM_{2.5}$ concentrations at the site. Conversely, when winds are blowing from the northwest and the monitor is upwind of these two sources, this results in the lowest concentrations at the site. Furthermore, an evaluation of the time period surrounding a 1-year temporary shutdown of this source shows that the monitor's annual average dropped below the level of the 2012 Annual $PM_{2.5}$ NAAQS during the shutdown but was well above the level of the NAAQS both before and after the shutdown. An evaluation of the chemical $PM_{2.5}$ speciation data before, during, and after the temporary shutdown of this local source, shows that the direct $PM_{2.5}$ components that are suspected to originate from this source are well above the St. Louis MSA background levels before and after the shutdown, but drop down to the background levels during the shutdown period. The evidence shows that without the influence of this local source, the monitor would attain the standard. For these reasons, the state is recommending a designation of attainment/unclassifiable for all counties on the Missouri side of the St. Louis MSA based on the evaluation of this violating monitor.

The evaluation of the East St. Louis monitor (Appendix B) provides evidence that local sources in Illinois could be causing the 2010 – 2012 design value to violate the NAAQS. This monitor only samples $PM_{2.5}$ every 1-in-6 days limiting the amount of data available for a weight of evidence analysis. In addition, there is no co-located chemical speciation network monitor at this site, meaning $PM_{2.5}$ speciation data is not available for analysis of this violating monitor. Due partly to these data limitations, the weight of evidence analysis did not provide any conclusive evidence of the specific sources that are causing/contributing to this violation. Additionally, looking at air quality trends at this site and across St. Louis it is possible that this monitor will come into compliance with the 2012 Annual $PM_{2.5}$ NAAQS after the 2013 calendar year is over and the design value is based on more recent air quality data. The analysis did not provide any conclusive evidence that emissions sources in Missouri were causing/contributing to this violation, and with a review of the current and planned future controls in place in Missouri, it is expected that this monitor will likely come into compliance with the NAAQS in the near future, based on local and federal control measures already in place. For these reasons, Missouri is not recommending any areas be designated nonattainment on the Missouri side of the St. Louis MSA due to nearby contribution to this violating monitor.

Other than the two Illinois monitors in the St. Louis area, no other monitors outside Missouri within 50 km from the border of the state are in violation of the 2012 Annual $PM_{2.5}$ NAAQS. Therefore no other evaluations aside from the evaluations performed for these two violating monitors were necessary in order to determine appropriate nonattainment boundaries. Based on the ambient air quality monitoring data from monitors located in Missouri and near Missouri, along with the evaluations performed for the Illinois monitors in the St. Louis MSA, Missouri's recommendation is for every county in the state to be designated attainment/unclassifiable.

Boundary Considerations – Technical Discussion

This evaluation was limited to the Missouri counties. Counties or portions of counties that exhibit a pattern of significant contribution are included for consideration to be included in a nonattainment area. A review of the contributing factors must be done in a consistent manner. In some cases a review of one of the factors argue for inclusion, but a review of other factors may not. The decision of whether or not a county is included must be made in a holistic fashion.

To determine trends, to make county comparisons, and to evaluate the information in a comprehensive manner, the department's Air Pollution Control Program chose to begin the review with counties located in the St. Louis MSA to determine based on a weight of evidence analysis if they are both nearby and contributing to the violations in the Illinois portion of the St. Louis area. The Missouri portion of the St. Louis MSA includes the City of St. Louis and the Counties of Franklin, Jefferson, St. Charles, St. Louis, Lincoln, and Warren. The next group of counties reviewed was the counties surrounding the MSA: Crawford, Gasconade, Montgomery, Pike, St. Francois, Ste. Genevieve, and Washington Counties. Finally, the rest of the state was analyzed based solely on ambient air quality data because no other areas in or nearby the state are violating the standard.

Missouri Portion of the St. Louis MSA - County by County Analysis

As mentioned above, weight of evidence evaluations have been performed for both of the violating monitors in the Illinois portion of the St. Louis MSA. These evaluations are included as Appendices A and B. The following discussions rely heavily upon these evaluations that have been performed. In an effort to consider all relevant data, county-by-county analyses are included below and include relevant data for each area evaluated. In the discussions below, emissions and emissions related data will compare each county's total emissions and emissions related data to the entire the IL/MO St. Louis MSA.

Table 4 includes the total IL/MO St. Louis emissions inventory for 2008 and 2011 for direct $PM_{2.5}$ and the following $PM_{2.5}$ precursors: oxides of nitrogen (NO_X), oxides of sulfur (SO_X), volatile organic compounds (VOC), and ammonia (NH_3). Area sources comprise a large percentage of direct $PM_{2.5}$ emissions from all counties in the IL/MO St. Louis MSA. However, a vast majority of the direct $PM_{2.5}$ emissions from area sources are calculated values for paved and unpaved roads and agricultural tilling. These emissions categories account for dust that is disturbed on roads by vehicles and in fields during agricultural tilling. These types of emissions are very local in nature, and quickly settle out of the air usually within 100 – 500 yards from their origin. Therefore, these types of emissions in Missouri, while significant to the overall percentage of direct $PM_{2.5}$ emissions in the MSA, would not have an impact on $PM_{2.5}$ concentrations recorded at the Granite City and East St. Louis monitors. Although it is noted that a marginal percentage of direct $PM_{2.5}$ emissions from paved and unpaved roads nearby the Granite City and East St. Louis monitors in Madison and St. Clair Counties could have an impact on the $PM_{2.5}$ concentrations recorded by these monitors, the vast majority of direct $PM_{2.5}$ emissions from these three emissions source categories in the IL/MO St. Louis MSA are not impacting the $PM_{2.5}$ concentrations in Granite City or East St. Louis. For this reason, direct $PM_{2.5}$ emissions from these three categories have been excluded from the emission inventories evaluated in this document.

Table 4 2008 and 2011 IL/MO St. Louis MSA Annual Emissions Inventory for $PM_{2.5}$ and $PM_{2.5}$ Precursors

Pollutant	2008 Annual Emissions Inventory		
	MO STL MSA	IL STL MSA	MO/IL STL MSA
Direct $PM_{2.5}$ (tons/year) *	13,796.16	6,351.64	**20,147.80**
SO_X (tons/year)	214,538.28	25,893.58	**240,431.86**
NO_X (tons/year)	122,032.69	39,825.39	**161,858.08**
VOC (tons/year)	83,096.14	46,336.71	**129,432.85**
NH_3 (tons/year)	7,637.40	7,332.89	**14,970.29**
Pollutant	**2011 Annual Emissions Inventory**		
	MO STL MSA	**IL STL MSA**	**MO/IL STL MSA**
Direct $PM_{2.5}$ (tons/year) *	14,110.92	6,447.97	**20,558.89**
SO_X (tons/year)	126,256.03	14,035.30	**140,291.33**
NO_X (tons/year)	97,022.51	31,627.96	**128,650.47**
VOC (tons/year)	62,602.05	17,937.17	**80,539.22**
NH_3 (tons/year)	6,656.07	6,773.28	**13,429.35**

* Note: This table does not include direct $PM_{2.5}$ emissions from paved and unpaved roads or agricultural tilling operations.

In addition to emissions inventory data, emissions related data is also relevant to consider when defining attainment/nonattainment boundaries. Emissions related data that was considered in the weight of evidence analyses for the Missouri/Illinois St. Louis MSA counties includes annual vehicle miles traveled (VMT) data, population, and commuting connectivity data. Tables 5 – 7 display this information by county for these three categories, respectively.

Table 5 MO/IL St. Louis MSA 2010 VMT

Missouri	2010 Annual VMT (in millions)
St. Louis	12,796.5
St. Louis City	3,656.5
St. Charles	2,903.6
Jefferson	1,945.9
Franklin	1,627.3
Lincoln	471.0
Warren	553.0
Illinois	**2010 Annual VMT (in millions)**
Clinton	387.7
Jersey	190.0
Madison	2,847.0
Monroe	359.8
St. Clair	2,671.1
MO/IL St. Louis MSA Totals	**30,409.6**

* Note: This information was pulled from EPA's $PM_{2.5}$ Boundary Designations Guidance and Tools Webpage: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm

Table 6 MO/IL St. Louis MSA 2010 Population

Missouri	2010 Population (in thousands)
St. Louis	1,016.3
St. Louis City	348.2
St. Charles	283.9
Jefferson	198.1
Franklin	93.8
Lincoln	38.9
Warren	24.5
Illinois	**2010 Population (in thousands)**
Clinton	**35.5**
Jersey	**21.7**
Madison	**258.9**
Monroe	**27.6**
St. Clair	**256.1**
MO/IL St. Louis MSA Totals	**2,603.6**

* Note: This information was pulled from EPA's $PM_{2.5}$ Boundary Designations Guidance and Tools Webpage: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm

Table 7 MO/IL St. Louis MSA Vehicle Commuting Connectivity Data *											
	Works In										
	Lincoln	Warren	Franklin	Washington	Jefferson	St. Charles	STL County	STL City	Madison	St. Clair	Monroe
Lives In											
Lincoln	9,167	473	95	0	114	7,278	4,150	720	52	43	0
Warren	333	5,088	979	0	54	4,935	2,068	325	63	48	0
Franklin	7	518	29,804	37	964	881	10,434	2,507	123	97	3
Washington	4	20	410	3,930	702	78	804	292	45	55	0
Jefferson	9	30	981	152	37,390	2,085	46,788	13,967	404	1,015	157
St. Charles	1,374	830	600	15	388	88,417	71,293	14,128	947	603	42
STL County	159	152	1,626	22	6,274	17,115	338,985	99,757	3,402	3,501	320
STL City	34	40	157	112	925	2,605	53,606	81,403	1,341	1,701	74
Madison	1	0	95	15	296	1,572	16,466	13,755	75,862	11,336	261
St. Clair	10	0	133	0	382	812	11,529	18,382	7,737	77,913	1,491
Monroe	0	0	39	0	335	169	3,718	2,792	365	2,457	5,747

* Note: The figures listed in the table above reflect the number of residents that live in the counties listed in the leftmost column and work in the counties listed in the top row. Source: US Census, 2006-2010 Residence County to Workplace County Flows, http://www.census.gov/population/metro/data/other.html

As seen in Tables 4 – 7, based on the magnitude of emissions alone, Missouri sources comprise a large percent of the region's overall emissions inventory. However, aggregate emissions in the MSA alone are not enough to determine the relative contribution of these emission sources to a particular $PM_{2.5}$ monitor violation. Analysis of emission point elevations, release parameters, and meteorological data are needed to perform quantitative dispersion/photochemical modeling and source apportionment analysis. However, despite limitations in quantitatively correlating aggregate emissions to unique monitored concentrations, a weight of evidence approach is used in Appendices A and B to demonstrate the likelihood of whether Missouri sources are causing or contributing to the magnitude of the violating monitors in Granite City and East St. Louis. This approach is discussed in detail in Appendices A and B and is appropriate since area wide monitored violations do not occur over the entire MO/IL St. Louis MSA.

In the pages that follow, a discussion of the weight of evidence analyses that were performed is provided for each county in the Missouri portion of the St. Louis MSA and each county in Missouri that borders the St. Louis MSA. The state's recommendation for designation is also included at the end of the discussion for each county. Due to the unique nature of the two violating monitors in the Illinois portion of the St. Louis MSA, focused weight of evidence analyses were performed to determine nearby contributing sources to the $PM_{2.5}$ concentrations in Granite City and East St. Louis (Appendices A and B). The conclusions drawn from Appendices A and B form the basis for the individual county by county recommendations listed below.

City of St. Louis

There are two ambient $PM_{2.5}$ monitors located in St. Louis City that are suitable for comparison to the annual $PM_{2.5}$ NAAQS. The Blair Street and South Broadway monitors each have 2010 – 2012 design values in compliance with the 2012 Annual $PM_{2.5}$ NAAQS. Because there are no monitors in the City of St. Louis that are violating the 2012 standard, a determination must be made as to whether the City of St. Louis contains nearby sources that are contributing to the violations in Granite City and East St. Louis. The fact that both monitors in the City of St. Louis, which are each located within one (1) mile of the Missouri/Illinois border, have 2010 – 2012 design values in compliance with the NAAQS argues that emissions from the City of St. Louis are not causing/contributing to the violations on the Illinois side of the St. Louis MSA.

Table 8 displays the 2008 and 2011 Emissions Inventory Data for the City of St. Louis. As seen in Table 8, in 2011 the City of St. Louis comprised 8% of the direct $PM_{2.5}$ emissions in MSA, 2% of the SO_2 emissions in the MSA, 8% of the NO_X emissions in the MSA, 11% of the VOC emissions in the MSA, and 6% of the NH_3 emissions in the MSA. Also as seen in Tables 5 – 7, 2010 VMT in the City of St. Louis comprised 12% of the total VMT in the MSA, and 2010 population in the City of St. Louis comprised 13% of the total MSA population. Commuting connectivity data suggests that a relatively insignificant number of St. Louis City residents work in Madison and St. Clair Counties (the counties with the violating monitors). While the emissions inventory data, VMT, and population in St. Louis City appear significant; emissions and emissions related data alone are not enough to determine the relative contribution of the emission sources in St. Louis City to the violating monitors in Granite City and East St. Louis.

Table 8 City of St. Louis 2008 and 2011 Annual Emissions Inventory Data *					
	2008 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	271.66	5,729.67	1,415.83	1,155.67	568.40
Nonpoint Sources	1,247.78	3,273.63	1,033.57	7,656.98	129.50
On-Road Sources	353.18	68.87	9,165.29	3,278.08	169.20
Non-Road Sources	152.6	101.01	4,078.51	1,146.65	2.21
Totals	**2,025.22**	**9,173.18**	**15,693.20**	**13,237.38**	**869.31**
St Louis MSA Percentage	**10%**	**4%**	**10%**	**10%**	**6%**
	2011 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	289.10	3,030.44	1,096.90	852.38	514.75
Nonpoint Sources	1,080.66	52.31	1,061.87	5,095.47	148.42
On-Road Sources	251.98	28.69	6,078.28	1,668.63	94.89
Non-Road Sources	95.12	28.29	2,064.89	985.94	1.47
Totals	**1,716.86**	**3,139.73**	**10,301.94**	**8,602.42**	**759.53**
St Louis MSA Percentage	**8%**	**2%**	**8%**	**11%**	**6%**

Note: This table does not include direct $PM_{2.5}$ emissions from paved and unpaved roads or agricultural tilling operations.

The weight of evidence analyses included in Appendices A and B, which consider not only emissions and emissions related data, but also emissions source location, meteorology data on high $PM_{2.5}$ episode days at each of the violating monitors, $PM_{2.5}$ speciation data in the City of St. Louis and at the location of the Granite City monitor, an analysis of 24-hour $PM_{2.5}$ concentrations on high $PM_{2.5}$ episode days at each of the violating monitors compared with the same days' 24-hour concentration values in the City of St. Louis, an evaluation of a temporary shutdown at a major emissions source located in Illinois, and an evaluation of current and planned future emissions controls in the City, concludes that sources located in the City of St. Louis are not causing or contributing to the violations in Granite City or East St. Louis.

Conclusion: While certain relevant factors could be used to argue for inclusion of the City of St. Louis in the nonattainment area that will result from the violating monitors in Illinois, the weight of evidence analyses, when considered holistically, show strong evidence and justification for a recommendation of attainment/unclassifiable for the City of St. Louis.

St. Louis County

There is one monitor located in St. Louis County with a 2010 – 2012 annual $PM_{2.5}$ design value that is suitable for comparison with the Annual $PM_{2.5}$ NAAQS. The Ladue monitor has a 2010 – 2012 design value of 10.9 $\mu g/m^3$. Because there are no monitors in St. Louis County that are violating the 2012 standard, a determination must be made as to whether St. Louis County contains nearby sources that are contributing to the violations in Granite City and East St. Louis. The fact that the only monitor in the County has a 2010 – 2012 design value well below the value of the NAAQS argues that emissions from St. Louis County are not causing/contributing to the violations on the Illinois side of the St. Louis MSA.

Table 9 displays the 2008 and 2011 Emissions Inventory Data for St. Louis County. As seen in Table 9, in 2011 St. Louis County comprised 27% of the direct $PM_{2.5}$ emissions in MSA, 11% of the SO_2 emissions in the MSA, 30% of the NO_X emissions in the MSA, 38% of the VOC emissions in the MSA, and 13% of the NH_3 emissions in the MSA. Also as seen in Tables 5 – 7, 2010 VMT in the St. Louis County comprised 42% of the total VMT in the MSA, and 2010 population in the St. Louis County comprised 39% of the total MSA population. However, commuting connectivity data suggests that a relatively insignificant number of St. Louis County residents work in Madison and St. Clair Counties. While the emissions inventory data, VMT, and population in St. Louis County appear significant; emissions and emissions related data alone are not enough to determine the relative contribution of the emission sources in St. Louis County to the violating monitors in Granite City and East St. Louis.

Table 9 St. Louis County 2008 and 2011 Annual Emissions Inventory Data *					
	2008 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	510.91	20,861.90	5,843.52	1,689.72	720.41
Nonpoint Sources	3,232.47	5,445.70	2,219.83	20,196.53	1,036.69
On-Road Sources	1,306.99	242.70	33,985.44	13,093.35	582.99
Non-Road Sources	618.2	329.92	9,344.46	6,513.17	7.33
Totals	**5,668.57**	**26,880.22**	**51,393.25**	**41,492.77**	**2,347.42**
St Louis MSA Percentage	**28%**	**11%**	**32%**	**32%**	**16%**
	2011 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	208.96	15,315.56	5,110.66	615.49	666.26
Nonpoint Sources	3,759.63	141.63	2,680.64	16,227.59	718.37
On-Road Sources	993.87	112.61	24,407.41	7,769.30	369.32
Non-Road Sources	574.04	239.45	6,413.31	5,936.10	7.46
Totals	**5,536.50**	**15,809.25**	**38,612.02**	**30,548.48**	**1,761.41**
St Louis MSA Percentage	**27%**	**11%**	**30%**	**38%**	**13%**

Note: This table does not include direct $PM_{2.5}$ emissions from paved and unpaved roads or agricultural tilling operations.

The weight of evidence analyses included in Appendices A and B, which consider not only emissions and emissions related data, but also emissions source location, meteorology data on high $PM_{2.5}$ episode days at each of the violating monitors, $PM_{2.5}$ speciation data, an analysis of 24-hour $PM_{2.5}$ concentrations on high $PM_{2.5}$ episode days at each of the violating monitors, an evaluation of a temporary shutdown at a major emissions source located in Illinois, and an evaluation of current and planned future emissions controls in the Missouri portion of the St. Louis MSA, concludes that sources located in St. Louis County are not causing or contributing to the violations in Granite City or East St. Louis.

Conclusion: While certain relevant factors could be used to argue for inclusion of St. Louis County in the nonattainment area that will result from the violating monitors in Illinois, the weight of evidence analyses, when considered holistically, show strong evidence and justification for a recommendation of attainment/unclassifiable for St. Louis County.

St. Charles County

There are no $PM_{2.5}$ monitors located in St. Charles County; therefore, the primary consideration is whether St. Charles County contains nearby sources that are contributing to the violations in Granite City and East St. Louis.

Table 10 displays the 2008 and 2011 Emissions Inventory Data for St. Charles County. As seen in Table 10, in 2011 St. Charles County comprised 10% of the direct $PM_{2.5}$

emissions in MSA, 4% of the SO_2 emissions in the MSA, 14% of the NO_X emissions in the MSA, 12% of the VOC emissions in the MSA, and 8% of the NH_3 emissions in the MSA. Also as seen in Tables 5 – 7, 2010 VMT in St. Charles County comprised 10% of the total VMT in the MSA, and 2010 population in St. Charles County comprised 11% of the total MSA population. However, the commuting connectivity data for St. Charles County is insignificant Madison County and St. Clair County. Furthermore, as displayed in Table 10, emissions of SO_X have decreased significantly from 2008 to 2011 in St. Charles County due mainly to installed controls at an Ameren UE electric generating facility located in the county. While the emissions inventory data, VMT, and population in St. Charles County appear significant; emissions and emissions related data alone are not enough to determine the relative contribution of the emission sources in St. Charles County to the violating monitors in Granite City and East St. Louis.

Table 10 St. Charles County 2008 and 2011 Annual Emissions Inventory Data *

	2008 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	316.21	48,595.17	7,649.32	936.97	8.04
Nonpoint Sources	630.05	895.18	461.25	5,758.92	883.43
On-Road Sources	302.58	55.44	8,119.75	3,663.73	132.82
Non-Road Sources	205.09	57.55	3,043.73	1,934.74	2.58
Totals	**1,453.93**	**49,603.34**	**19,274.05**	**12,294.36**	**1,026.87**
St Louis MSA Percentage	**7%**	**21%**	**12%**	**9%**	**7%**
	2011 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	445.05	5,323.84	7,369.86	802.09	4.78
Nonpoint Sources	1,120.96	33.58	626.90	4,791.81	899.54
On-Road Sources	313.41	34.81	7,761.68	2,627.92	113.53
Non-Road Sources	180.06	49.67	2,178.97	1,700.07	2.46
Totals	**2,059.48**	**5,441.90**	**17,937.41**	**9,921.89**	**1,020.31**
St Louis MSA Percentage	**10%**	**4%**	**14%**	**12%**	**8%**

Note: This table does not include direct $PM_{2.5}$ emissions from paved and unpaved roads or agricultural tilling operations.

The weight of evidence analyses included in Appendices A and B, which consider not only emissions and emissions related data, but also emissions source location, meteorology data on high $PM_{2.5}$ episode days at each of the violating monitors, $PM_{2.5}$ speciation data, an analysis of 24-hour $PM_{2.5}$ concentrations on high $PM_{2.5}$ episode days at each of the violating monitors, an evaluation of a temporary shutdown at a major emissions source located in Illinois, and an evaluation of current and planned future emissions controls in the Missouri portion of the St. Louis MSA, concludes that sources located in St. Charles County are not causing or contributing to the violations in Granite City or East St. Louis. In fact, meteorological data indicates that a significant portion of the lowest $PM_{2.5}$ episode days at these two monitors are associated with winds traveling over St. Charles County into the Illinois Counties of St. Clair and Madison.

Conclusion: While certain relevant factors could be used to argue for inclusion of St. Charles County in the nonattainment area that will result from the violating monitors in Illinois, the weight of evidence analyses, when considered holistically, show strong evidence and justification for a recommendation of attainment/unclassifiable for St. Charles County.

Franklin County

There are no $PM_{2.5}$ monitors located in Franklin County; therefore, the primary consideration is whether Franklin County contains nearby sources that are contributing to the violations in Granite City and East St. Louis.

Table 11 displays the 2008 and 2011 Emissions Inventory Data for Franklin County. As seen in Table 11, in 2011 Franklin County comprised 12% of the direct $PM_{2.5}$ emissions in MSA, 41% of the SO_2 emissions in the MSA, 11% of the NO_X emissions in the MSA, 5% of the VOC emissions in the MSA, and 10% of the NH_3 emissions in the MSA. However, as seen in Tables 5 – 7, 2010 VMT in Franklin County comprised only 5% of the total VMT in the MSA, and 2010 population in Franklin County comprised only 4% of the total MSA population. Also, the commuting connectivity data for Franklin County is insignificant Madison County and St. Clair County. While the emissions inventory data in Franklin County appears significant; aggregate emissions data alone are not enough to determine the relative contribution of the emission sources in Franklin County to the violating monitors in Granite City and East St. Louis.

Table 11 Franklin County 2008 and 2011 Annual Emissions Inventory Data *

	2008 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	1,448.96	57,944.69	9,178.19	685.48	2.82
Nonpoint Sources	423.94	991.04	282.40	1,603.65	1,300.09
On-Road Sources	142.43	30.12	4,187.48	1,574.13	77.75
Non-Road Sources	138.11	36.52	3,056.58	1,036.21	1.74
Totals	**2,153.44**	**59,002.37**	**16,704.65**	**4,899.47**	**1,382.40**
St Louis MSA Percentage	**11%**	**25%**	**10%**	**4%**	**9%**
	2011 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	1,714.56	57,948.83	9,898.13	640.66	3.07
Nonpoint Sources	513.07	37.28	227.38	1,469.19	1,265.49
On-Road Sources	117.34	13.14	2,896.06	912.88	43.05
Non-Road Sources	96.30	25.81	1,712.41	918.33	1.23
Totals	**2,441.27**	**58,025.06**	**14,733.98**	**3,941.06**	**1,312.84**
St Louis MSA Percentage	**12%**	**41%**	**11%**	**5%**	**10%**

Note: This table does not include direct $PM_{2.5}$ emissions from paved and unpaved roads or agricultural tilling operations.

The weight of evidence analyses included in Appendices A and B, which consider not only emissions and emissions related data, but also emissions source location, meteorology data on high $PM_{2.5}$ episode days at each of the violating monitors, $PM_{2.5}$ speciation data, an analysis of 24-hour $PM_{2.5}$ concentrations on high $PM_{2.5}$ episode days at each of the violating monitors, an evaluation of a temporary shutdown at a major emissions source located in Illinois, and an evaluation of current and planned future emissions controls in the Missouri portion of the St. Louis MSA, concludes that sources located in Franklin County are not causing or contributing to the violations in Granite City or East St. Louis.

Conclusion: While certain relevant factors could be used to argue for inclusion of Franklin County in the nonattainment area that will result from the violating monitors in Illinois, the weight of evidence analyses, when considered holistically, show strong evidence and justification for a recommendation of attainment/unclassifiable for Franklin County.

Jefferson County

There is one monitor located in St. Louis County with a 2010 – 2012 annual $PM_{2.5}$ design value that is suitable for comparison with the Annual $PM_{2.5}$ NAAQS. The Ladue monitor has a 2010 – 2012 design value of 10.1 $\mu g/m^3$ (the lowest design value out of all $PM_{2.5}$ monitors in the IL/MO St. Louis MSA). Because there are no monitors in Jefferson County that are violating the 2012 standard, a determination must be made as to whether Jefferson County contains nearby sources that are contributing to the violations in Granite City and East St. Louis. The fact that the only monitor in the county has a 2010 – 2012 design value in compliance with the NAAQS and is lower than any other monitor's design value in the entire MSA argues that emissions from Jefferson County are not causing/contributing to the violations on the Illinois side of the St. Louis MSA.

Table 12 displays the 2008 and 2011 Emissions Inventory Data for Jefferson County. As seen in Table 12, in 2011 Jefferson County comprised 8% of the direct $PM_{2.5}$ emissions in MSA, 31% of the SO_2 emissions in the MSA, 9% of the NO_X emissions in the MSA, 8% of the VOC emissions in the MSA, and 2% of the NH_3 emissions in the MSA. As seen in Tables 5 – 7, 2010 population in Jefferson County comprised 8% of the total MSA population. However, 2010 VMT in Jefferson County comprised only 6% of the total VMT in the MSA, and the commuting connectivity data for Jefferson County is insignificant Madison County and St. Clair County. While the emissions inventory data and population in Jefferson County appear significant; emissions and emissions related data alone are not enough to determine the relative contribution of the emission sources in Jefferson County to the violating monitors in Granite City and East St. Louis.

Table 12 Jefferson County 2008 and 2011 Annual Emissions Inventory Data *					
	2008 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	945.65	68,569.28	7,016.40	600.04	8.97
Nonpoint Sources	717.78	904.61	383.49	3,127.96	165.26
On-Road Sources	192.81	36.88	5,476.95	2,552.86	90.42
Non-Road Sources	85.82	19.29	1,199.29	914.76	1.06
Totals	**1,942.06**	**69,530.06**	**14,076.13**	**7,195.62**	**265.71**
St Louis MSA Percentage	**10%**	**29%**	**9%**	**6%**	**2%**
	2011 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	511.82	43,702.04	5,608.14	483.33	7.61
Nonpoint Sources	965.22	35.11	368.80	3,157.62	175.35
On-Road Sources	183.67	20.45	4,600.80	1,637.25	66.35
Non-Road Sources	77.01	20.04	886.91	846.05	1.03
Totals	**1,737.72**	**43,777.64**	**11,464.65**	**6,124.25**	**250.34**
St Louis MSA Percentage	**8%**	**31%**	**9%**	**8%**	**2%**

Note: This table does not include direct $PM_{2.5}$ emissions from paved and unpaved roads or agricultural tilling operations.

The weight of evidence analyses included in Appendices A and B, which consider not only emissions and emissions related data, but also emissions source location, meteorology data on high $PM_{2.5}$ episode days at each of the violating monitors, $PM_{2.5}$ speciation data, an analysis of 24-hour $PM_{2.5}$ concentrations on high $PM_{2.5}$ episode days at each of the violating monitors, an evaluation of a temporary shutdown at a major emissions source located in Illinois, and an evaluation of current and planned future emissions controls in the Missouri portion of the St. Louis MSA, concludes that sources located in Jefferson County are not causing or contributing to the violations in Granite City or East St. Louis.

Conclusion: While certain relevant factors could be used to argue for inclusion of Jefferson County in the nonattainment area that will result from the violating monitors in Illinois, the weight of evidence analyses, when considered holistically, show strong evidence and justification for a recommendation of attainment/unclassifiable for Jefferson County.

Lincoln and Warren Counties

There are no $PM_{2.5}$ monitors located in Lincoln or Warren Counties; therefore, the primary consideration is whether the Counties of Lincoln or Warren contain nearby sources that are contributing to the violations in Granite City and East St. Louis.

Tables 13 – 14 display the 2008 and 2011 Emissions Inventory Data for the Counties of Lincoln and Warren, respectively. As seen in the tables, emissions are much lower in Lincoln and Warren Counties as compared to the other counties of the Missouri MSA.

Also as seen in Tables 5 – 7, the VMT, general population, and commuting connectivity data associated with Madison and St. Clair Counties is insignificant. All of these factors argue for a designation of attainment/unclassifiable for these two counties.

Table 13 Lincoln County 2008 and 2011 Annual Emissions Inventory Data *					
	2008 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	0.27	0.06	37.29	79.04	-
Nonpoint Sources	222.50	87.53	74.97	880.44	1,010.92
On-Road Sources	41.46	9.36	1,398.85	744.21	22.93
Non-Road Sources	65.30	29.67	1,166.46	520.81	0.79
Totals	**329.53**	**126.62**	**2,677.57**	**2,224.50**	**1,034.64**
St Louis MSA Percentage	**2%**	**0%**	**2%**	**2%**	**7%**
	2011 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	0.33	0.04	29.56	66.11	-
Nonpoint Sources	255.15	16.00	89.00	909.00	863.00
On-Road Sources	44.99	10.88	1,326.74	494.68	18.42
Non-Road Sources	44.69	12.11	618.41	444.22	0.58
Totals	**345.16**	**39.03**	**2,063.71**	**1,914.01**	**882.00**
St Louis MSA Percentage	**2%**	**0%**	**2%**	**2%**	**7%**

Note: This table does not include direct $PM_{2.5}$ emissions from paved and unpaved roads or agricultural tilling operations.

Table 14 Warren County 2008 and 2011 Annual Emissions Inventory Data *					
	2008 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	0.86	0.06	10.24	171.17	0.77
Nonpoint Sources	140.14	205.98	78.27	674.21	681.24
On-Road Sources	53.66	9.66	1,740.09	633.81	28.70
Non-Road Sources	28.75	6.79	385.24	272.85	0.34
Totals	**223.41**	**222.49**	**2,213.84**	**1,752.04**	**711.05**
St Louis MSA Percentage	**1%**	**0%**	**1%**	**1%**	**5%**
	2011 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	-	-	0.11	206.12	-
Nonpoint Sources	191.73	5.36	57.09	663.71	647.55
On-Road Sources	56.54	10.96	1,553.57	448.78	21.77
Non-Road Sources	25.66	7.10	298.03	231.33	0.32
Totals	**273.93**	**23.42**	**1,908.80**	**1,549.94**	**669.64**
St Louis MSA Percentage	**1%**	**0%**	**1%**	**2%**	**5%**

Note: This table does not include direct $PM_{2.5}$ emissions from paved and unpaved roads or agricultural tilling operations.

In addition to the relatively low emissions inventories and emissions related data, the location of these two counties are further from the violating monitors in Illinois than any other counties in the entire IL/MO St. Louis MSA, which would support a designation of

attainment for these two counties. In addition, the weight of evidence analyses included in Appendices A and B, which consider not only emissions and emissions related data, but also emissions source location, meteorology data on high $PM_{2.5}$ episode days at each of the violating monitors, $PM_{2.5}$ speciation data, an analysis of 24-hour $PM_{2.5}$ concentrations on high $PM_{2.5}$ episode days at each of the violating monitors, an evaluation of a temporary shutdown at a major emissions source located in Illinois, and an evaluation of current and planned future emissions controls in the Missouri portion of the St. Louis MSA, also concludes that sources located in Lincoln and Warren Counties are not causing or contributing to the violations in Granite City or East St. Louis.

Conclusion: Virtually all factors considered in the weight of evidence analyses show strong evidence and justification for a designation of attainment/unclassifiable for the Counties of Lincoln and Warren.

Missouri Areas Surrounding the St. Louis MSA – County by County Analysis

Per EPA's Guidance on Boundary Designations under the 2012 Annual $PM_{2.5}$ NAAQS, evaluations should also be performed for all counties that are adjacent to CBSAs with violating monitors. For this reason, the designation criteria in each Missouri County that borders the St. Louis MSA have also been evaluated. There are no ambient $PM_{2.5}$ monitors located in the Missouri counties that border the St. Louis MSA, so the primary question is whether these counties contain nearby emissions sources that cause/contribute to the violations in the Illinois portion of the St. Louis MSA.

Table 15 displays the 2010 annual VMT and the 2010 general populations of each Missouri County that borders the St. Louis MSA, and Tables 16 – 22 display the 2008 and 2011 Emissions Inventory Data for the Missouri counties that border the MSA. As seen in the tables, VMT, general population, and emissions inventory data are much lower in the counties surrounding the MSA than in the counties that comprise the MSA. Commuting connectivity data is not available for the surrounding counties, but it is assumed that there is very low connectivity associated with any of the surrounding counties and the counties in Illinois with the violating monitors. All of these points argue for each Missouri County surrounding the MSA to be designated attainment/unclassifiable. However, point sources in these counties were included in the weight of evidence analyses included in Appendices A and B, due to the fact that some of the counties that surround the MSA do contain relatively large point sources, which could potentially argue for inclusion in the nonattainment area that will result from the violating monitors on the Illinois side of the St. Louis MSA.

Table 15 VMT and Population Data (2010) for Missouri Counties Bordering the St. Louis MSA		
	2010 Annual VMT (in millions)	**2010 Population (in thousands)**
Washington	209.6	23.3
Gasconade	148.8	15.3
Crawford	520.3	22.8
St. Francois	540.6	55.6
Ste. Genevieve	435.3	17.8
Pike	263.4	18.4
Montgomery	429.2	12.1

* Note: This information was pulled from EPA's $PM_{2.5}$ Boundary Designations Guidance and Tools Webpage: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm

Table 16 Washington County 2008 and 2011 Annual Emissions Inventory Data *					
	2008 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	0.72	0.03	5.42	18.31	0.09
Nonpoint Sources	103.00	142.74	61.64	333.23	212.59
On-Road Sources	23.01	4.09	744.59	373.06	11.56
Non-Road Sources	9.27	2.18	131.94	106.44	0.12
Totals	**136.00**	**149.04**	**943.59**	**831.04**	**224.36**
St Louis MSA Percentage	**1%**	**0%**	**1%**	**1%**	**1%**
	2011 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	0.87	0.01	4.43	39.99	0.10
Nonpoint Sources	114.91	3.72	38.33	369.72	184.67
On-Road Sources	22.50	4.62	653.31	243.51	8.99
Non-Road Sources	7.87	2.32	101.00	90.89	0.11
Totals	**146.15**	**10.67**	**797.07**	**744.11**	**193.87**
St Louis MSA Percentage	**1%**	**0%**	**1%**	**1%**	**1%**

Note: This table does not include direct $PM_{2.5}$ emissions from paved and unpaved roads or agricultural tilling operations.

Table 17 Gasconade County 2008 and 2011 Annual Emissions Inventory Data *					
	2008 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	0.14	0.01	1.88	145.12	0.06
Nonpoint Sources	58.32	91.59	36.89	481.71	585.89
On-Road Sources	17.45	2.97	558.30	314.91	8.22
Non-Road Sources	41.88	12.05	1,048.58	214.95	0.56
Totals	**117.79**	**106.62**	**1,645.65**	**1,156.69**	**594.73**
St Louis MSA Percentage	**1%**	**0%**	**1%**	**1%**	**4%**
	2011 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	0.14	0.01	1.84	122.75	0.06
Nonpoint Sources	84.62	5.13	39.66	427.03	515.86
On-Road Sources	16.87	3.39	497.50	213.09	6.49
Non-Road Sources	26.10	7.95	576.14	165.81	0.36
Totals	**127.73**	**16.48**	**1,115.14**	**928.68**	**522.77**
St Louis MSA Percentage	**1%**	**0%**	**1%**	**1%**	**4%**

Note: This table does not include direct $PM_{2.5}$ emissions from paved and unpaved roads or agricultural tilling operations.

Table 18 Crawford County 2008 and 2011 Annual Emissions Inventory Data *					
	2008 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	-	-	-	36.04	-
Nonpoint Sources	114.81	86.05	56.14	886.15	265.33
On-Road Sources	49.04	9.05	1,599.71	631.48	27.01
Non-Road Sources	31.02	3.88	277.05	668.55	0.28
Totals	**194.87**	**98.98**	**1,932.90**	**2,222.22**	**292.62**
St Louis MSA Percentage	**1%**	**0%**	**1%**	**2%**	**2%**
	2011 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	-	-	-	27.14	-
Nonpoint Sources	127.02	6.94	67.69	673.66	235.19
On-Road Sources	48.58	10.03	1,365.95	414.76	19.86
Non-Road Sources	27.40	4.22	187.27	648.11	0.26
Totals	**203.00**	**21.19**	**1,620.91**	**1,763.67**	**255.31**
St Louis MSA Percentage	**1%**	**0%**	**1%**	**2%**	**2%**

Note: This table does not include direct $PM_{2.5}$ emissions from paved and unpaved roads or agricultural tilling operations.

Table 19 St. Francois County 2008 and 2011 Annual Emissions Inventory Data *					
	2008 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	27.36	25.71	403.95	46.73	17.59
Nonpoint Sources	209.56	380.71	127.00	912.00	461.00
On-Road Sources	72.58	11.32	2,057.37	1,028.77	29.35
Non-Road Sources	19.74	4.16	235.50	267.44	0.23
Totals	**329.24**	**421.90**	**2,823.82**	**2,254.94**	**508.17**
St Louis MSA Percentage	**2%**	**0%**	**2%**	**2%**	**3%**
	2011 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	28.89	28.17	439.70	30.57	11.05
Nonpoint Sources	306.15	11.50	127.17	941.13	404.66
On-Road Sources	55.65	11.57	1,645.41	661.42	22.40
Non-Road Sources	18.55	4.84	191.88	241.04	0.24
Totals	**409.24**	**56.08**	**2,404.16**	**1,874.16**	**438.35**
St Louis MSA Percentage	**2%**	**0%**	**2%**	**2%**	**3%**

Note: This table does not include direct $PM_{2.5}$ emissions from paved and unpaved roads or agricultural tilling operations.

Table 20 Ste. Genevieve County 2008 and 2011 Annual Emissions Inventory Data *					
	2008 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	302.80	4,432.97	5,246.81	59.96	0.06
Nonpoint Sources	113.83	258.47	67.56	555.92	799.93
On-Road Sources	36.39	7.27	1,203.34	432.05	21.73
Non-Road Sources	23.66	5.95	440.60	219.62	0.30
Totals	**476.68**	**4,704.66**	**6,958.31**	**1,267.55**	**822.02**
St Louis MSA Percentage	**2%**	**2%**	**4%**	**1%**	**5%**
	2011 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	808.62	3,716.98	6,918.07	347.95	54.28
Nonpoint Sources	100.27	5.12	49.48	403.95	829.47
On-Road Sources	40.57	7.95	1,065.00	304.86	15.68
Non-Road Sources	20.00	6.15	357.87	183.47	0.29
Totals	**969.46**	**3,736.20**	**8,390.42**	**1,240.23**	**899.72**
St Louis MSA Percentage	**5%**	**3%**	**7%**	**2%**	**7%**

Note: This table does not include direct $PM_{2.5}$ emissions from paved and unpaved roads or agricultural tilling operations.

Table 21 Pike County 2008 and 2011 Annual Emissions Inventory Data *					
	2008 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	287.55	13,422.42	7,244.57	686.71	44.96
Nonpoint Sources	115.97	850.82	174.91	500.70	1,415.95
On-Road Sources	30.06	5.18	916.87	380.23	14.55
Non-Road Sources	72.02	24.98	1,403.71	567.07	0.86
Totals	**505.60**	**14,303.40**	**9,740.06**	**2,134.71**	**1,476.32**
St Louis MSA Percentage	**3%**	**6%**	**6%**	**2%**	**10%**
	2011 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	62.20	1,835.92	807.43	67.70	23.27
Nonpoint Sources	72.12	2.77	37.84	505.99	2,193.73
On-Road Sources	33.29	6.49	914.85	264.78	12.91
Non-Road Sources	48.93	13.50	806.48	482.70	0.63
Totals	**216.54**	**1,858.68**	**2,566.60**	**1,321.17**	**2,230.54**
St Louis MSA Percentage	**1%**	**1%**	**2%**	**2%**	**17%**

Note: This table does not include direct $PM_{2.5}$ emissions from paved and unpaved roads or agricultural tilling operations.

Table 22 Montgomery County 2008 and 2011 Annual Emissions Inventory Data *					
	2008 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	25.04	578.44	170.16	-	-
Nonpoint Sources	67.00	86.94	38.56	481.16	855.85
On-Road Sources	35.43	6.84	1,212.25	377.61	21.12
Non-Road Sources	30.00	7.10	427.85	139.66	0.31
Totals	**157.47**	**679.32**	**1,848.83**	**998.42**	**877.28**
St Louis MSA Percentage	**1%**	**0%**	**1%**	**1%**	**6%**
	2011 Annual Emissions (tons/year)				
Source Category	**Direct $PM_{2.5}$**	**SO_2/SO_X**	**NO_X**	**VOC**	**NH_3**
Point Sources	0.05	549.52	147.67	-	-
Nonpoint Sources	65.53	2.21	26.92	479.04	857.58
On-Road Sources	42.70	8.45	1,154.87	273.35	17.03
Non-Road Sources	24.34	6.80	322.80	115.55	0.29
Totals	**132.62**	**566.98**	**1,652.27**	**867.94**	**874.89**
St Louis MSA Percentage	**1%**	**0%**	**1%**	**1%**	**7%**

Note: This table does not include direct $PM_{2.5}$ emissions from paved and unpaved roads or agricultural tilling operations.

In addition to the relatively low emissions inventory and emissions related data, the Missouri counties that surround the St. Louis MSA are located even further away from the violating monitors in Illinois, which also argues for a designation of attainment/unclassifiable. In addition, the weight of evidence analyses included in Appendices A and B, which consider not only emissions and emissions related data, but also emissions source location, meteorology data on high $PM_{2.5}$ episode days at each of the violating monitors, $PM_{2.5}$ speciation data, an analysis of 24-hour $PM_{2.5}$ concentrations on high $PM_{2.5}$ episode days at each of the violating monitors, an evaluation of a temporary shutdown at a major emissions source located in Illinois, and an evaluation of current and planned future emissions controls in the Missouri portion of the St. Louis MSA and the counties that surround the MSA, concludes that sources located in Missouri counties that surround the MSA are not causing or contributing to the violations in Granite City and East St. Louis.

Conclusion: Even though there are a few large point sources located in some of the Missouri counties that surround the MSA, the location of these sources in proximity to the violating monitors, the total emissions from these counties, the emissions related data from these counties, and the weight of evidence analyses performed provide strong evidence and justification for each of Missouri's counties that surround the St. Louis MSA to be designated attainment/unclassifiable.

Other Counties – The Rest of the State

As discussed in the Summary of Recommendation Section of this document, all $PM_{2.5}$ monitors that are suitable for comparison to the annual $PM_{2.5}$ NAAQS that are located in the State of Missouri have 2010 – 2012 design values in compliance with the 2012 Annual $PM_{2.5}$ NAAQS. In addition, no monitors outside Missouri but within 50 km of the state border are violating the NAAQS aside from the two monitors on the Illinois side of the St. Louis MSA. For this reason, all areas of Missouri outside the St. Louis area are also recommended for designation as attainment/unclassifiable because the air quality in these areas is in compliance with the standard, and there are no areas nearby any of these counties that are violating the standard that would warrant an evaluation of nearby contributing sources to determine appropriate designation boundaries.

Conclusion

All ambient $PM_{2.5}$ monitors in Missouri that are suitable for comparison to the 2012 Annual $PM_{2.5}$ NAAQS are complying with the standard based on EPA certified monitoring data from 2010 – 2012. There are two ambient $PM_{2.5}$ monitors near Missouri in the Illinois portion of the St. Louis MSA that are violating the 2012 Annual $PM_{2.5}$ NAAQS. The state performed evaluations for each of these two violating monitors in an effort to determine nearby sources that were causing/contributing to these violations.

These evaluations (Appendices A and B) both come to the conclusion that a recommendation of attainment/unclassifiable is most appropriate for all Missouri counties located in and surrounding the St. Louis MSA. The evaluations are based on a weight of evidence approach and consider each of the five criteria that EPA includes in its guidance for determining boundaries under the 2012 Annual $PM_{2.5}$ NAAQS. In addition to the criteria included in the EPA guidance, the state evaluated the potential for additional controls that could be installed on Missouri sources in the St. Louis area. Even if areas in Missouri were to be included in a nonattainment area as a result of the violating monitors in the Illinois portion of the St. Louis MSA, few if any new controls in Missouri, beyond what is already in place or expected in the near future, would actually be required for the area. This means there would be no net air quality benefit by designating areas in Missouri nonattainment based on these violating monitors; it would only require Missouri to develop a resource intensive attainment demonstration for the area. Finally, the downward trend in annual $PM_{2.5}$ concentrations across the state and in the St. Louis area over the last decade is only expected to continue as a result of control measures that are already in place.

For all of these reasons the State of Missouri recommends each county in the State for designation as attainment/unclassifiable under the 2012 Annual $PM_{2.5}$ NAAQS.

Missouri
Department of
Natural Resources

Appendix A

Evaluation of the Fire Station #1 $PM_{2.5}$ Monitor
Located in Granite City, Illinois
(AQS Site ID: 17-119-1007)

Table of Contents

List of Tables

List of Figures

Evaluation of the Fire Station #1 $PM_{2.5}$ Monitor Located in Granite City, Illinois (AQS Site ID: 17-119-1007)

1. Background and Approach

1.1 Fine Particulate Matter Background Information

Fine Particulate Matter ($PM_{2.5}$) is one of seven different criteria pollutants for which EPA has established a National Ambient Air Quality Standard (NAAQS). This pollutant includes all particles, both solid and liquid, that have an aerodynamic diameter less than 2.5 micrometers. For this reason, there is no single chemical formula for $PM_{2.5}$. Instead, $PM_{2.5}$ is comprised of dozens of different chemical species. Additionally, $PM_{2.5}$ can be emitted directly (primary $PM_{2.5}$), or it can be formed through chemical reactions of precursor pollutants in the atmosphere (secondary $PM_{2.5}$).

Primary $PM_{2.5}$ includes all nongaseous particles with aerodynamic diameters less than 2.5 micrometers in size that are emitted directly from an emissions source. Examples of primary $PM_{2.5}$ include microscopic dust particles; oxides of metals from milling and smelting operations; organic carbon particles from the combustion of fossil fuels and biomass; and other microscopic particles that aren't fully combusted during combustion processes. The three speciation categories most heavily impacted by primary $PM_{2.5}$ emissions include organic carbon particulates, elemental carbon particulates, and crustal particulates. Primary $PM_{2.5}$ emissions have an immediate impact on ambient $PM_{2.5}$ concentrations in the local area surrounding the emissions source; however, as distance from the emissions source increases, the $PM_{2.5}$ concentrations resulting from the primary $PM_{2.5}$ emissions quickly disperse bringing $PM_{2.5}$ concentrations back down to regional/local background levels only a few miles away from the primary $PM_{2.5}$ emissions source. Under low and calm wind conditions, primary $PM_{2.5}$ emissions cannot disperse and buildups of $PM_{2.5}$ concentrations can occur around sources of primary $PM_{2.5}$ emissions.

Secondary $PM_{2.5}$ includes several different chemical species, each of which forms under different conditions. The three speciation categories most heavily impacted by secondary $PM_{2.5}$ include sulfates, nitrates and organic carbon particulates. Sulfates are formed from sulfur dioxide (SO_2) emissions from power plants and industrial facilities. Nitrates are formed from emissions of nitrogen oxides (NO_X) from power plants, automobiles, and other combustion sources. Secondary organic particulates result from gaseous organic emissions from mobile and stationary fossil fuel combustion sources, industrial chemicals, gasoline evaporation, and biogenic emissions. Secondary $PM_{2.5}$ formation is a process that can take hours or days and is primarily responsible for long range transportation contribution to $PM_{2.5}$ levels in other areas.

Sources of primary $PM_{2.5}$ include the following:

- Stationary sources that burn fossil fuels:
  - Organic carbon particles and elemental carbon particles from power plants, industrial/commercial/residential heating/combustion equipment
  - Oxides of trace metals from coal or oil combustion
- Mobile sources that burn fossil fuels:
  - Organic carbon particles and elemental carbon particles from the exhaust of cars, trucks, buses, locomotives, marine engines, and off-road equipment
  - Fugitive dust from on-road and off-road vehicles/equipment
- Industrial processes:
  - Organic carbon particles, elemental carbon particles, and oxides of metals from smelting, milling, and asphalt production
- Construction activities:
  - Fugitive dust from construction/earth moving activities
  - Organic carbon particles and elemental carbon particles from the exhaust of off-road equipment
- Agricultural operations:
  - Fugitive dust from earth moving/agricultural tilling
  - Organic carbon particles and elemental carbon particles from the exhaust of off-road farming equipment
- Non-anthropogenic sources:
  - Organic carbon particles and elemental carbon particles from wild fires

Sources of secondary $PM_{2.5}$ precursors that react in the air to form secondary $PM_{2.5}$ include:

- Stationary sources that burn fossil fuels
  - SO_2, NO_X, and gaseous organic emissions from power plants, industrial/commercial/residential heating/combustion equipment
- Mobile sources that burn fossil fuels
  - SO_2, NO_X, and gaseous organic emissions from exhaust of cars, trucks, buses, locomotives, marine engines, and off-road equipment
  - Gaseous organic emissions from gasoline/diesel fuel evaporation
- Gasoline fueling and refining
  - SO_2, NO_X, and gaseous organic emissions from refining operations
  - Gaseous organic emissions from gasoline/diesel fuel evaporation
- Surface coating operations
  - Gaseous organic emissions from solvent evaporation
- Industrial processes
  - SO_2, NO_X, and gaseous organic emissions from fossil fuel combustion
  - Gaseous organic emissions from solvent/chemical/liquid fuel evaporation
- Agricultural operations
  - Ammonia (NH_3) and gaseous organic emissions from fertilizers/animal feeding operations
  - SO_2, NO_X, and gaseous organic emissions from exhaust of off-road farming equipment
- Mining
  - Gaseous organic emissions from vented mine shafts
- Biogenic Sources
  - NH_3, NO_X, and gaseous organic emissions from vegetative and biological processes

1.2 2012 Annual PM2.5 NAAQS

On January 15, 2013, EPA promulgated $PM_{2.5}$ air quality standards (78 FR 3036). These standards were based on a number of health studies showing that increased exposure to $PM_{2.5}$ is correlated with increased mortality and a range of serious health effects, including aggravation of lung disease, asthma attacks, and heart problems. EPA established a new primary standard for $PM_{2.5}$. The standard is based on an annual average and was set at a level of 12 micrograms per cubic meter ($\mu g/m^3$). Under the same action, EPA retained the existing secondary annual standard for $PM_{2.5}$, the existing primary and secondary 24-hour standards for $PM_{2.5}$, as well the existing primary and secondary standards for particulate matter with aerodynamic diameters of 10 microns or less (PM_{10}).

In the St. Louis area, there are two (2) $PM_{2.5}$ air quality monitors that are suitable for comparison with the annual $PM_{2.5}$ NAAQS and are currently violating the newly established $PM_{2.5}$ standard. Both of these monitors are located in Illinois. Per the Clean Air Act Amendments of 1990, any area with a monitor that has a design value in violation of a NAAQS is to be designated nonattainment. Additionally, nearby areas with sources that are contributing to the violation shall be included in the nonattainment area that results from the violating monitor. This Appendix evaluates one of these violating monitors located in Granite City, Illinois in an effort to determine the sources that are causing/contributing to the violation.

1.3 Evaluation Approach

In an effort to determine the contributing sources to the ambient $PM_{2.5}$ concentrations recorded by the "Fire Station #1" $PM_{2.5}$ monitor located in Granite City, Illinois (hereafter referred to as the Granite City monitor) with a 2010 – 2012 annual $PM_{2.5}$ design value in violation of the 2012 Annual $PM_{2.5}$ NAAQS, the Missouri Department of Natural Resources has performed an evaluation of the following: monitoring data from the Granite City Monitor and other ambient $PM_{2.5}$ monitors located in the MO/IL St. Louis Metropolitan Statistical Area (MSA), the emissions sources located in the St. Louis MSA, the wind directions on days with the top 5% and bottom 5% recorded 24-hour $PM_{2.5}$ concentrations at the Granite City monitor from 2010 – 2012, modeled wind trajectories for these same days, and seasonal variations in monitored concentrations at the site.

Additionally, the $PM_{2.5}$ average concentrations at the Granite City monitor were calculated and reviewed for each calendar quarter during the period from 2007 – 2010. A significant $PM_{2.5}$ emission source located less than a mile to the south of the monitor was shutdown in 2009. Therefore by reviewing the concentrations during these years, the goal is to determine the impact that this emission source has on $PM_{2.5}$ concentrations at this monitor. Finally, a review of Missouri's major emissions sources in the area along with current and planned future control measures was performed to determine the level of potentially controllable emissions in Missouri that might be impacting the $PM_{2.5}$ concentrations at this site.

1.4 Episode Days Evaluated

Much of the evaluation performed to determine the contributing sources to the current violation at the Granite City monitor focused on a set of days during 2010 – 2012 when monitored $PM_{2.5}$ concentrations were at their highest and lowest. The high days were selected for evaluation as they drive the annual average higher, contributing significantly to the violation of the 2012 annual $PM_{2.5}$ standard. The low days were selected to determine if certain meteorological conditions tend to result in lower ambient $PM_{2.5}$ concentrations at this particular monitor. For both the high and low days, the highest and lowest 5 percent 24-hour value concentrations recorded at this monitor in each year from 2010 – 2012 were evaluated. The value of 5 percent equates to 17 or 18 days in the year as this monitor recorded $PM_{2.5}$ concentrations an average of 340 days per year during the 2010 – 2012 time frame. This was determined to be a sufficient number of episode days to evaluate, to ensure that enough data is analyzed to obtain representative trends, while keeping the amount of resources necessary for the evaluation at a manageable level.

Table 1 lists the dates used as episode days throughout much of this evaluation.

Table 1. Episode Days Evaluated at the Granite City Monitor

Granite City High Days			Granite City Low Days		
2010	2011	2012	2010	2011	2012
3/9/2010	1/28/2011	11/17/2012	4/25/2010	10/14/2011	4/21/2012
2/4/2010	1/17/2011	11/21/2012	3/13/2010	10/20/2011	10/19/2012
2/3/2010	7/16/2011	11/18/2012	9/3/2010	11/17/2011	4/11/2012
8/8/2010	6/8/2011	7/4/2012	5/8/2010	9/5/2011	9/18/2012
12/19/2010	2/4/2011	12/24/2012	2/2/2010	10/19/2011	3/12/2012
1/15/2010	1/24/2011	6/29/2012	7/6/2010	4/12/2011	1/7/2012
12/20/2010	1/27/2011	7/2/2012	11/5/2010	4/16/2011	2/24/2012
8/7/2010	6/9/2011	11/28/2012	9/7/2010	11/27/2011	11/23/2012
1/16/2010	1/25/2011	2/17/2012	10/18/2010	5/2/2011	9/8/2012
12/28/2010	6/3/2011	11/20/2012	3/14/2010	9/15/2011	10/6/2012
2/21/2010	1/18/2011	9/6/2012	5/4/2010	9/7/2011	2/11/2012
4/13/2010	3/31/2011	11/16/2012	5/17/2010	4/20/2011	1/1/2012
1/23/2010	9/2/2011	6/30/2012	9/27/2010	3/23/2011	1/3/2012
8/9/2010	8/2/2011	7/7/2012	1/28/2010	5/16/2011	6/21/2012
12/10/2010	6/7/2011	1/10/2012	1/19/2010	11/29/2011	1/17/2012
12/9/2010	6/4/2011	4/2/2012	10/14/2010	5/15/2011	10/5/2012
3/8/2010	8/1/2011	11/15/2012	3/1/2010	5/14/2011	1/2/2012
	5/10/2011			9/6/2011	

2. $PM_{2.5}$ Design Values at St. Louis Area $PM_{2.5}$ Monitors

2.1 2010 – 2012 Annual PM2.5 Design Values in the Illinois/Missouri St. Louis MSA

To begin the evaluation, the 2010 – 2012 annual $PM_{2.5}$ design values at all monitors located in Missouri and Illinois were reviewed. All monitoring data used throughout this Appendix were pulled from EPA's Air Quality System (AQS). Figure 1 displays a map of the $PM_{2.5}$ monitoring network in the MO/IL St. Louis MSA. The $PM_{2.5}$ annual design values from 2010 – 2012 are listed below in Table 2. A quick review of the design values shows that all monitors located on the Missouri side of the St. Louis MSA that are suitable for comparison to the annual $PM_{2.5}$ NAAQS are in compliance with the 2012 annual $PM_{2.5}$ standard, while two monitors located in Illinois have 2010 – 2012 design values above the level of the standard. This evaluation focuses on the violating monitor located in Granite City, Illinois. A separate evaluation was performed for the violating monitor located in East St. Louis, Illinois, which can be found in Appendix B.

Table 2	2010 – 2012 Design Values at Monitors Located in the St. Louis MSA *		
Annual $PM_{2.5}$ Monitoring Data (all values in micrograms/cubic meter ($\mu g/m^3$)) **			
Missouri Monitors			
Site Location	**AQS Site ID**	**County**	**2010 - 2012 Annual Design Value**
Arnold West	29-099-0019	Jefferson	10.1
South Broadway	29-510-0007	St. Louis City	11.0
Blair Street	29-510-0085	St. Louis City	11.7
Ladue	29-189-3001	St. Louis County	10.9
Illinois Monitors			
Site Location	**AQS Site ID**	**County**	**2010 - 2012 Design Value**
Alton	17-119-2009	Madison	11.8
Wood River	17-119-3007	Madison	11.6
East St. Louis	17-163-0010	St. Clair	12.2
Granite City	17-119-1007	Madison	13.5

* Note: Monitoring data was pulled from Federal Equivalent Method (FEM) and Federal Reference Method (FRM) $PM_{2.5}$ air quality monitors in the St. Louis area that are acceptable for comparison to the Annual $PM_{2.5}$ NAAQS, per EPA's July 2013 Air Quality Design Value Review: http://www.epa.gov/ttn/analysis/dvreview.htm

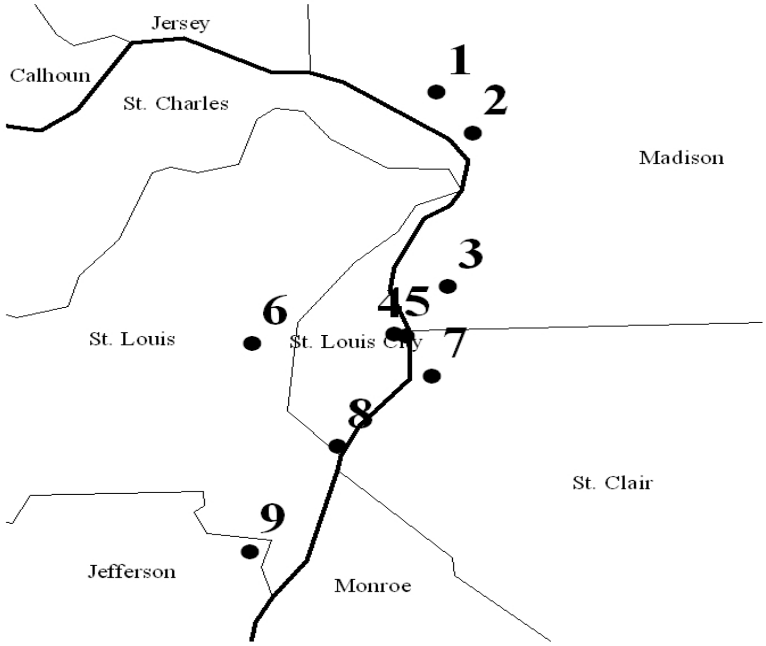
** Note: All values have been rounded to the nearest 0.1 microgram/cubic meter

Figure 1 Illinois/Missouri St. Louis MSA $PM_{2.5}$ Monitoring Network

Missouri	
Site #	**Site Location**
4	Blair Street
5	Branch Street *
6	Ladue
8	South Broadway
9	Arnold West

* Note: unique middle-scale monitor not comparable to Annual $PM_{2.5}$ NAAQS

Illinois	
Site #	**Site Location**
1	Alton
2	Wood River
3	Granite City
7	East St. Louis



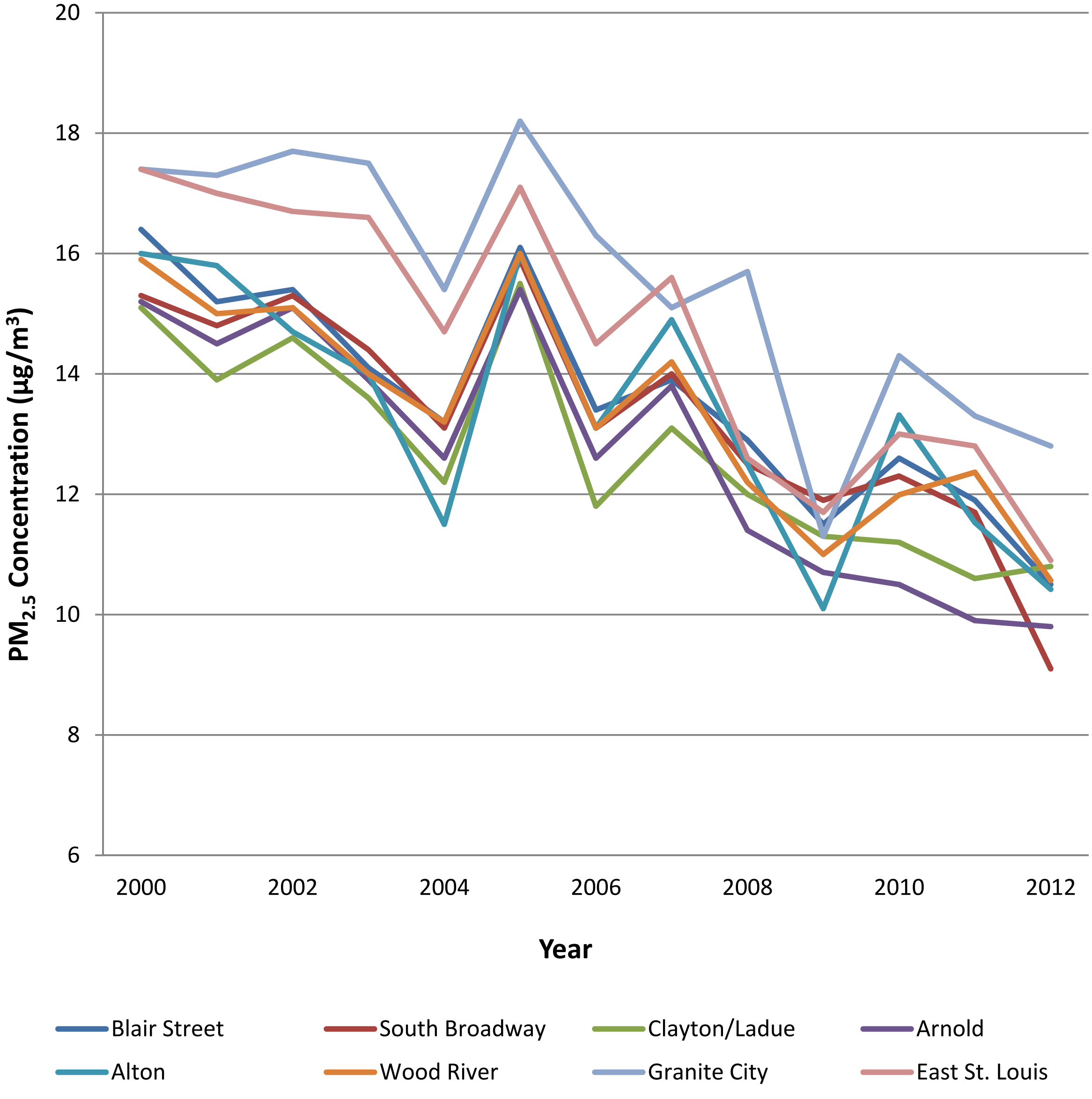
Note: The Branch Street monitor is defined as a unique middle scale monitor and has been given a legacy exemption meaning it is not comparable to the 2012 Annual $PM_{2.5}$ NAAQS, per EPA's July 2013 Air Quality Design Value Review: http://www.epa.gov/ttn/analysis/dvreview.htm. This monitor is not representative of area-wide $PM_{2.5}$ concentrations as many of the episodes and trends recorded at the Branch Street monitor are unique to this location and not experienced across the St. Louis Region even by the neighborhood scale Blair Street monitor, which is less than 800 m from the Branch Street monitor location. Therefore, while trends and episodes at this monitor are useful and relevant for comparison and analysis of the 24-hour $PM_{2.5}$ NAAQS, the episodes and design values at this monitor are not suitable for comparison and analysis of the Annual $PM_{2.5}$ NAAQS. For additional details regarding the Branch Street monitor's status as a unique middle scale monitor, please see Appendix C.

2.2 Annual $PM_{2.5}$ Design Value Trends in the Illinois/Missouri St. Louis Area (2002 – 2012)

It is important to understand that significant improvements in $PM_{2.5}$ concentrations have been achieved across the entire MO/IL St. Louis MSA over the past decade as a result of both regional and local emission control strategies that have been implemented during this timeframe. Figure 2 displays the annual average $PM_{2.5}$ concentrations from 2002 – 2012 for each of the St. Louis area monitors listed in Table 2. As can be seen, the declining trend in $PM_{2.5}$ concentrations is persistent across the entire region. Average $PM_{2.5}$ concentrations across the region have reduced from approximately 16 µg/m^3 in 2000 down to approximately 11 µg/m^3 in 2012. This declining trend in $PM_{2.5}$ concentrations across the Region show that control strategies currently in place have been effective and are resulting in the continued improvement in $PM_{2.5}$ concentrations. As federal control measures such as motor vehicle and non-road engine standards, the Clean Air Interstate Rule phase II (or its expected replacement), the Boiler Maximum Achievable Control Technology Standards, and the Utility Mercury and Air Toxics Standards become phased in, regional emissions reductions in St. Louis and across the country are only expected to continue, which will continue the downward trend in $PM_{2.5}$ concentrations measured across the St. Louis area.

As seen in Figure 2, the Granite City monitor consistently records average annual $PM_{2.5}$ concentrations approximately 2 $\mu g/m^3$ – 3 $\mu g/m^3$ above the average levels recorded by all other monitors in the St. Louis area. The evaluation in this Appendix focuses on this trend and analyzes the sources suspected of causing the consistently elevated $PM_{2.5}$ concentrations at this monitor.

Figure 2 IL/MO St. Louis Area $PM_{2.5}$ Monitors Annual $PM_{2.5}$ Concentration Trends (2000 - 2012)



3. Emissions Data

3.1 Emissions Inventory Data

Tables 3 – 7 list the emissions of direct $PM_{2.5}$ and the $PM_{2.5}$ precursors, oxides of nitrogen (NO_X), oxides of sulfur (SO_X), volatile organic compounds (VOC), and ammonia (NH_3), respectively, for each county in the Illinois/Missouri St. Louis MSA in tons/year by source category for both 2008 and 2011. The point and area source emissions inventories listed in these tables for Missouri and Illinois were generated for submission to EPA for the National Emissions Inventory in these two years. Mobile source emissions in Missouri and Illinois were calculated by the Missouri Department of Natural Resources and the Illinois EPA. NONROAD 2008 was used to develop the non-road mobile source emissions with county specific data, and EPA's Motor Vehicle Emissions Simulator (MOVES) version 2010b was used to develop the on-road mobile source emissions with county specific data.

Area sources comprise a large percentage of direct $PM_{2.5}$ emissions from all counties in the MO/IL St. Louis MSA. However, a vast majority of the direct $PM_{2.5}$ emissions from area sources are calculated values for paved and unpaved roads and agricultural tilling. These emissions categories account for dust that is disturbed on roads by vehicles and in fields during agricultural tilling. These types of emissions are very local in nature, and quickly settle out of the air usually within 100 – 500 yards from their origin. Therefore, these types of emissions in Missouri, while significant to the overall percentage of direct $PM_{2.5}$ emissions in the MSA, would not have an impact on $PM_{2.5}$ concentrations recorded at the Granite City monitor. Although it is noted that a marginal percentage direct $PM_{2.5}$ emissions from paved and unpaved roads nearby the Granite City monitor in Madison County could have an impact on the $PM_{2.5}$ concentrations recorded by the Granite City monitor, the vast majority of direct $PM_{2.5}$ emissions from these three emissions source categories in the IL/MO St. Louis MSA are not impacting the $PM_{2.5}$ concentrations in Granite City. For this reason, direct $PM_{2.5}$ emissions from these three categories have been excluded from the area source category for all counties evaluated in Table 3 to allow for a more focused evaluation on emissions that may be impacting the violating monitor in Granite City.

As seen in the following tables, all the Missouri counties included in the MSA except for Lincoln and Warren have a significant amount of emissions from point, on-road, and non-road categories for all pollutants reviewed. There are also significant emissions on the Illinois side, particularly in Madison County (the location of the Granite City Monitor), but generally speaking, the emissions from the Missouri side of the MSA comprise a majority from the entire MSA.

Looking at mobile source emissions from 2008 to 2011 shows a general decline in all emission categories evaluated from 2008 – 2011. This is the result of federal motor vehicle and non-road engine standards that have been phased in and the retirement of older higher polluting mobile source engines. In addition to federal motor vehicle emissions standards, Missouri implements reformulated gasoline requirements in the St. Louis area along with an inspection and maintenance (I/M) program for all vehicles registered in the City of St. Louis and the Counties of St. Louis, St. Charles, Franklin, and Jefferson. This I/M program ensures that vehicles in the area fix the emission controls on their vehicles when they break and eliminates any attempts for

residents to tamper with the emission control devices on their vehicles, thus ensuring the emissions reductions expected from the federal motor vehicle standards remain in place. Therefore, the trend of declining mobile source emissions is expected to continue in the St. Louis area.

When analyzing point source emissions, particularly for the pollutant categories of SO_X and NO_X a vast majority of the emissions result from electric generating units, and are emitted from stacks hundreds of feet in the air. This results in dispersion and prevents high concentrations of these pollutants from forming at ground-level. While these types of emissions do contribute to $PM_{2.5}$ concentrations as they undergo chemical reactions in the atmosphere, the $PM_{2.5}$ contribution can result hundreds of miles away from the actual emission source, meaning they contribute more to regional background levels than they do to the local MSA. Therefore, these types of emissions sources have typically been controlled in the past through regional emission control programs aimed at reducing the impact of emissions on downwind state ambient air pollutant concentrations. This issue is further analyzed in Subsection 5.2 through the evaluation of speciation data at the Granite City monitor.

Based on the magnitude of emissions alone, Missouri sources comprise a large percent of the region's overall emissions inventory. However, aggregate emissions in the MSA alone are not enough to determine the relative contribution of these emission sources to a particular $PM_{2.5}$ monitor violation. Analysis of emission point elevations, release parameters, and meteorological data are needed to perform quantitative dispersion/photochemical modeling and source apportionment analysis. However, despite limitations in quantitatively correlating aggregate emissions to unique monitored concentrations, a weight of evidence approach is used in this document to demonstrate the likelihood of whether Missouri sources are causing or contributing to the magnitude of the violating monitor in Granite City. This approach is discussed in the sections that follow and is appropriate since area wide monitored violations do not occur over the entire St. Louis MO-IL MSA.

Table 3 Direct $PM_{2.5}$ Emissions and Percentages by County and Source Category in the Illinois/Missouri St. Louis MSA in 2008 and 2011 *										
	2008 Direct $PM_{2.5}$ Emissions (Tons/Year)					2011 Direct $PM_{2.5}$ Emissions (Tons/Year)				
Missouri	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
St. Louis	510.91	3,232.47	1,306.99	618.2	**5,668.57**	208.96	3,759.63	993.87	574.04	**5,536.50**
	9.41%	32.40%	42.26%	37.47%	**28.13%**	4.65%	30.80%	42.21%	38.07%	**26.93%**
St. Louis City	271.66	1,247.78	353.18	152.6	**2,025.22**	289.10	1,080.66	251.98	95.12	**1,716.86**
	5.00%	12.51%	11.42%	9.25%	**10.05%**	6.44%	8.85%	10.70%	6.31%	**8.35%**
St. Charles	316.21	630.05	302.58	205.09	**1,453.93**	445.05	1,120.96	313.41	180.06	**2,059.48**
	5.82%	6.32%	9.78%	12.43%	**7.22%**	9.91%	9.18%	13.31%	11.94%	**10.02%**
Jefferson	945.65	717.78	192.81	85.82	**1,942.06**	511.82	965.22	183.67	77.01	**1,737.72**
	17.42%	7.20%	6.23%	5.20%	**9.64%**	11.40%	7.91%	7.80%	5.11%	**8.45%**
Franklin	1,448.96	423.94	142.43	138.11	**2,153.44**	1,714.56	513.07	117.34	96.30	**2,441.27**
	26.68%	4.25%	4.61%	8.37%	**10.69%**	38.19%	4.20%	4.98%	6.39%	**11.87%**
Lincoln	0.27	222.5	41.46	65.30	**329.53**	0.33	255.15	44.99	44.69	**345.16**
	0.00%	2.23%	1.34%	3.96%	**1.64%**	0.01%	2.09%	1.91%	2.96%	**1.68%**
Warren	0.86	140.14	53.66	28.75	**223.41**	-	191.73	56.54	25.66	**273.93**
	0.02%	1.40%	1.74%	1.74%	**1.11%**	0.00%	1.57%	2.40%	1.70%	**1.33%**
Missouri MSA	**3,494.52**	**6,614.66**	**2,393.11**	**1,293.87**	**13,796.16**	**3,169.82**	**7,886.42**	**1,961.80**	**1,092.88**	**14,110.92**
	64.35%	**66.31%**	**77.38%**	**78.43%**	**68.47%**	**70.61%**	**64.60%**	**83.33%**	**72.48%**	**68.64%**
	2008 Direct $PM_{2.5}$ Emissions (Tons/Year)					2011 Direct $PM_{2.5}$ Emissions (Tons/Year)				
Illinois	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
Clinton	60.20	265.07	32.85	47.06	**405.18**	48.22	289.05	20.89	50.61	**408.77**
	1.11%	2.66%	1.06%	2.85%	**2.01%**	1.07%	2.37%	0.89%	3.36%	**1.99%**
Jersey	0.87	151.43	17.98	25.99	**196.27**	0.00	147.72	9.44	27.70	**184.86**
	0.02%	1.52%	0.58%	1.58%	**0.97%**	0.00%	1.21%	0.40%	1.84%	**0.90%**
Madison	1,781.41	1,492.74	311.41	142.27	**3,727.84**	1,232.23	1,438.24	176.97	154.79	**3,002.23**
	32.81%	14.96%	10.07%	8.62%	**18.50%**	27.45%	11.78%	7.52%	10.27%	**14.60%**
Monroe	3.35	268.6	38.36	31.25	**341.57**	0.51	228.94	20.26	59.62	**309.33**
	0.06%	2.69%	1.24%	1.89%	**1.70%**	0.01%	1.88%	0.86%	3.95%	**1.50%**
St. Clair	89.73	1,182.78	298.97	109.30	**1,680.78**	38.32	2,217.24	165.03	122.19	**2,542.77**
	1.65%	11.86%	9.67%	6.63%	**8.34%**	0.85%	18.16%	7.01%	8.10%	**12.37%**
Illinois MSA	**1,935.56**	**3,360.62**	**699.58**	**355.88**	**6,351.64**	**1,319.28**	**4,321.19**	**392.58**	**414.92**	**6,447.97**
	35.65%	**33.69%**	**22.62%**	**21.57%**	**31.53%**	**29.39%**	**35.40%**	**16.67%**	**27.52%**	**31.36%**
MSA Total	**5,430.08**	**9,975.28**	**3,092.69**	**1,649.75**	**20,147.80**	**4,489.10**	**12,207.61**	**2,354.38**	**1,507.80**	**20,558.89**

* Note: The percentages listed in the table above indicate each area's percentage of the total IL/MO St. Louis MSA Direct $PM_{2.5}$ emissions during the applicable year for the applicable source category. This table does not include direct $PM_{2.5}$ emissions from paved and unpaved roads or agricultural tilling operations.

Table 4 NO$_X$ Emissions and Percentages by County and Source Category in the Illinois/Missouri St. Louis MSA in 2008 and 2011 *										
	2008 NO$_X$ Emissions (Tons/Year)					2011 NO$_X$ Emissions (Tons/Year)				
Missouri	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
St. Louis	5,843.52	2,219.83	33,985.44	9,344.46	**51,393.25**	5,110.66	2,680.64	24,407.41	6,413.31	**38,612.02**
	12.84%	21.02%	42.75%	35.56%	**31.75%**	12.73%	39.44%	40.16%	30.61%	**30.01%**
St. Louis City	1,415.83	1,033.57	9,165.29	4,078.51	**15,693.20**	1,096.90	1,061.87	6,078.28	2,064.89	**10,301.94**
	3.11%	9.79%	11.53%	15.52%	**9.70%**	2.73%	15.62%	10.00%	9.86%	**8.01%**
St. Charles	7,649.32	461.25	8,119.75	3,043.73	**19,274.05**	7,369.86	626.90	7,761.68	2,178.97	**17,937.41**
	16.80%	4.37%	10.21%	11.58%	**11.91%**	18.36%	9.22%	12.77%	10.40%	**13.94%**
Jefferson	7,016.40	383.49	5,476.95	1,199.29	**14,076.13**	5,608.14	368.80	4,600.80	886.91	**11,464.65**
	15.41%	3.63%	6.89%	4.56%	**8.70%**	13.97%	5.43%	7.57%	4.23%	**8.91%**
Franklin	9,178.19	282.40	4,187.48	3,056.58	**16,704.65**	9,898.13	227.38	2,896.06	1,712.41	**14,733.98**
	20.16%	2.67%	5.27%	11.63%	**10.32%**	24.66%	3.35%	4.77%	8.17%	**11.45%**
Lincoln	37.29	74.97	1,398.85	1,166.46	**2,677.57**	29.56	89.00	1,326.74	618.41	**2,063.71**
	0.08%	0.71%	1.76%	4.44%	**1.65%**	0.07%	1.31%	2.18%	2.95%	**1.60%**
Warren	10.24	78.27	1,740.09	385.24	**2,213.84**	0.11	57.09	1,553.57	298.03	**1,908.80**
	0.02%	0.74%	2.19%	1.47%	**1.37%**	0.00%	0.84%	2.56%	1.42%	**1.48%**
Missouri MSA	**31,150.79**	**4,533.78**	**64,073.85**	**22,274.27**	**122,032.69**	**29,113.36**	**5,111.68**	**48,624.54**	**14,172.93**	**97,022.51**
	68.43%	**42.94%**	**80.59%**	**84.77%**	**75.39%**	**72.54%**	**75.20%**	**80.01%**	**67.65%**	**75.42%**
	2008 NO$_X$ Emissions (Tons/Year)					2011 NO$_X$ Emissions (Tons/Year)				
Illinois	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
Clinton	2,338.04	747.56	1,050.72	588.95	**4,725.27**	3,025.57	131.99	688.74	750.24	**4,596.53**
	5.14%	7.08%	1.32%	2.24%	**2.92%**	7.54%	1.94%	1.13%	3.58%	**3.57%**
Jersey	0.04	319.44	513.01	281.28	**1,113.77**	-	67.98	323.13	466.31	**857.42**
	0.00%	3.03%	0.65%	1.07%	**0.69%**	0.00%	1.00%	0.53%	2.23%	**0.67%**
Madison	11,384.21	1,869.27	6,722.10	1,586.61	**21,562.18**	7,648.65	731.19	5,411.02	2,258.69	**16,049.56**
	25.01%	17.70%	8.46%	6.04%	**13.32%**	19.06%	10.76%	8.90%	10.78%	**12.48%**
Monroe	10.86	1,328.75	832.78	359.07	**2,531.46**	8.25	108.04	654.08	1,452.80	**2,223.18**
	0.02%	12.58%	1.05%	1.37%	**1.56%**	0.02%	1.59%	1.08%	6.93%	**1.73%**
St. Clair	635.92	1,759.76	6,309.87	1,187.16	**9,892.71**	337.23	646.36	5,069.61	1,848.07	**7,901.27**
	1.40%	16.67%	7.94%	4.52%	**6.11%**	0.84%	9.51%	8.34%	8.82%	**6.14%**
Illinois MSA	**14,369.07**	**6,024.78**	**15,428.48**	**4,003.07**	**39,825.39**	**11,019.69**	**1,685.57**	**12,146.58**	**6,776.12**	**31,627.96**
	31.57%	**57.06%**	**19.41%**	**15.23%**	**24.61%**	**27.46%**	**24.80%**	**19.99%**	**32.35%**	**24.58%**
MSA Total	**45,519.86**	**10,558.56**	**79,502.33**	**26,277.34**	**161,858.08**	**40,133.05**	**6,797.25**	**60,771.12**	**20,949.05**	**128,650.47**

* Note: The percentages listed in the table above indicate each area's percentage of the total IL/MO St. Louis MSA NO$_X$ emissions during the applicable year for the applicable source category.

Table 5 SO_X Emissions and Percentages by County and Source Category in the Illinois/Missouri St. Louis MSA in 2008 and 2011										
	2008 SO_X Emissions (Tons/Year)					2011 SO_X Emissions (Tons/Year)				
Missouri	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
St. Louis	20,861.90	5,445.70	242.70	329.92	**26,880.22**	15,315.56	141.63	112.61	239.45	**15,809.25**
	9.18%	44.96%	45.54%	56.18%	**11.18%**	11.02%	25.17%	38.01%	50.92%	**11.27%**
St. Louis City	5,729.67	3,273.63	68.87	101.01	**9,173.18**	3,030.44	52.31	28.69	28.29	**3,139.73**
	2.52%	27.03%	12.92%	17.20%	**3.82%**	2.18%	9.30%	9.68%	6.02%	**2.24%**
St. Charles	48,595.17	895.18	55.44	57.55	**49,603.34**	5,323.84	33.58	34.81	49.67	**5,441.90**
	21.39%	7.39%	10.40%	9.80%	**20.63%**	3.83%	5.97%	11.75%	10.56%	**3.88%**
Jefferson	68,569.28	904.61	36.88	19.29	**69,530.06**	43,702.04	35.11	20.45	20.04	**43,777.64**
	30.18%	7.47%	6.92%	3.28%	**28.92%**	31.45%	6.24%	6.90%	4.26%	**31.20%**
Franklin	57,944.69	991.04	30.12	36.52	**59,002.37**	57,948.83	37.28	13.14	25.81	**58,025.06**
	25.50%	8.18%	5.65%	6.22%	**24.54%**	41.70%	6.63%	4.43%	5.49%	**41.36%**
Lincoln	0.06	87.53	9.36	29.67	**126.62**	0.04	16.00	10.88	12.11	**39.03**
	0.00%	0.72%	1.76%	5.05%	**0.05%**	0.00%	2.84%	3.67%	2.58%	**0.03%**
Warren	0.06	205.98	9.66	6.79	**222.49**	-	5.36	10.96	7.10	**23.42**
	0.00%	1.70%	1.81%	1.16%	**0.09%**	0.00%	0.95%	3.70%	1.51%	**0.02%**
Missouri MSA	**201,700.83**	**11,803.67**	**453.03**	**580.75**	**214,538.28**	**125,320.75**	**321.27**	**231.54**	**382.47**	**126,256.03**
	88.78%	**97.46%**	**85.01%**	**98.90%**	**89.23%**	**90.18%**	**57.10%**	**78.14%**	**81.34%**	**90.00%**
	2008 SO_X Emissions (Tons/Year)					2011 SO_X Emissions (Tons/Year)				
Illinois	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
Clinton	414.81	18.28	4.57	1.51	**439.17**	357.78	12.88	3.77	3.70	**378.14**
	0.18%	0.15%	0.86%	0.26%	**0.18%**	0.26%	2.29%	1.27%	0.79%	**0.27%**
Jersey	0.01	8.46	2.16	0.53	**11.16**	-	7.27	1.91	18.10	**27.28**
	0.00%	0.07%	0.41%	0.09%	**0.00%**	0.00%	1.29%	0.64%	3.85%	**0.02%**
Madison	24,956.78	136.62	35.35	2.16	**25,130.91**	13,136.21	101.01	28.49	15.00	**13,280.71**
	10.98%	1.13%	6.63%	0.37%	**10.45%**	9.45%	17.95%	9.62%	3.19%	**9.47%**
Monroe	0.19	34.75	4.40	0.66	**39.99**	0.10	11.17	3.58	38.72	**53.56**
	0.00%	0.29%	0.83%	0.11%	**0.02%**	0.00%	1.98%	1.21%	8.23%	**0.04%**
St. Clair	127.98	109.33	33.40	1.62	**272.34**	147.38	108.99	27.00	12.24	**295.62**
	0.06%	0.90%	6.27%	0.28%	**0.11%**	0.11%	19.37%	9.11%	2.60%	**0.21%**
Illinois MSA	**25,499.77**	**307.44**	**79.88**	**6.48**	**25,893.58**	**13,641.47**	**241.33**	**64.76**	**87.74**	**14,035.30**
	11.22%	**2.54%**	**14.99%**	**1.10%**	**10.77%**	**9.82%**	**42.90%**	**21.86%**	**18.66%**	**10.00%**
MSA Total	**227,200.60**	**12,111.11**	**532.91**	**587.23**	**240,431.86**	**138,962.22**	**562.60**	**296.30**	**470.21**	**140,291.33**

* Note: The percentages listed in the table above indicate each area's percentage of the total IL/MO St. Louis MSA SO_X emissions during the applicable year for the applicable source category.

Table 6 VOC Emissions and Percentages by County and Source Category in the Illinois/Missouri St. Louis MSA in 2008 and 2011

	2008 VOC Emissions (Tons/Year)					2011 VOC Emissions (Tons/Year)				
Missouri	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
St. Louis	1,689.72	20,196.53	13,093.35	6,513.17	**41,492.77**	615.49	16,227.59	7,769.30	5,936.10	**30,548.48**
	17.87%	27.66%	42.86%	39.72%	**32.06%**	8.29%	40.58%	39.62%	43.89%	**37.93%**
St. Louis City	1,155.67	7,656.98	3,278.08	1,146.65	**13,237.38**	852.38	5,095.47	1,668.63	985.94	**8,602.42**
	12.22%	10.49%	10.73%	6.99%	**10.23%**	11.49%	12.74%	8.51%	7.29%	**10.68%**
St. Charles	936.97	5,758.92	3,663.73	1,934.74	**12,294.36**	802.09	4,791.81	2,627.92	1,700.07	**9,921.89**
	9.91%	7.89%	11.99%	11.80%	**9.50%**	10.81%	11.98%	13.40%	12.57%	**12.32%**
Jefferson	600.04	3,127.96	2,552.86	914.76	**7,195.62**	483.33	3,157.62	1,637.25	846.05	**6,124.25**
	6.35%	4.28%	8.36%	5.58%	**5.56%**	6.51%	7.90%	8.35%	6.26%	**7.60%**
Franklin	685.48	1,603.65	1,574.13	1,036.21	**4,899.47**	640.66	1,469.19	912.88	918.33	**3,941.06**
	7.25%	2.20%	5.15%	6.32%	**3.79%**	8.63%	3.67%	4.66%	6.79%	**4.89%**
Lincoln	79.04	880.44	744.21	520.81	**2,224.50**	66.11	909.00	494.68	444.22	**1,914.01**
	0.84%	1.21%	2.44%	3.18%	**1.72%**	0.89%	2.27%	2.52%	3.28%	**2.38%**
Warren	171.17	674.21	633.81	272.85	**1,752.04**	206.12	663.71	448.78	231.33	**1,549.94**
	1.81%	0.92%	2.07%	1.66%	**1.35%**	2.78%	1.66%	2.29%	1.71%	**1.92%**
Missouri MSA	**5,318.09**	**39,898.69**	**25,540.17**	**12,339.19**	**83,096.14**	**3,666.18**	**32,314.39**	**15,559.44**	**11,062.04**	**62,602.05**
	56.24%	**54.64%**	**83.60%**	**75.24%**	**64.20%**	**49.41%**	**80.82%**	**79.34%**	**81.80%**	**77.73%**
	2008 VOC Emissions (Tons/Year)					2011 VOC Emissions (Tons/Year)				
Illinois	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
Clinton	155.87	4,583.87	428.35	959.02	**6,127.11**	208.70	623.59	253.05	338.31	**1,423.65**
	1.65%	6.28%	1.40%	5.85%	**4.73%**	2.81%	1.56%	1.29%	2.50%	**1.77%**
Jersey	9.74	4,445.62	208.14	336.64	**5,000.14**	7.44	377.85	129.21	166.99	**681.49**
	0.10%	6.09%	0.68%	2.05%	**3.86%**	0.10%	0.94%	0.66%	1.23%	**0.85%**
Madison	3,215.56	9,849.25	2,116.34	1,459.46	**16,640.61**	2,985.15	3,230.54	1,762.02	1,059.03	**9,036.73**
	34.01%	13.49%	6.93%	8.90%	**12.86%**	40.23%	8.08%	8.99%	7.83%	**11.22%**
Monroe	18.17	4,988.85	264.60	340.76	**5,612.38**	15.05	514.86	232.92	182.31	**945.14**
	0.19%	6.83%	0.87%	2.08%	**4.34%**	0.20%	1.29%	1.19%	1.35%	**1.17%**
St. Clair	738.10	9,259.40	1,994.64	964.34	**12,956.47**	537.71	2,924.06	1,673.50	714.89	**5,850.16**
	7.81%	12.68%	6.53%	5.88%	**10.01%**	7.25%	7.31%	8.53%	5.29%	**7.26%**
Illinois MSA	**4,137.43**	**33,127.00**	**5,012.06**	**4,060.22**	**46,336.71**	**3,754.04**	**7,670.91**	**4,050.70**	**2,461.52**	**17,937.17**
	43.76%	**45.36%**	**16.40%**	**24.76%**	**35.80%**	**50.59%**	**19.18%**	**20.66%**	**18.20%**	**22.27%**
MSA Total	**9,455.52**	**73,025.69**	**30,552.23**	**16,399.41**	**129,432.85**	**7,420.22**	**39,985.30**	**19,610.14**	**13,523.56**	**80,539.22**

* Note: The percentages listed in the table above indicate each area's percentage of the total IL/MO St. Louis MSA VOC emissions during the applicable year for the applicable source category.

Table 7 NH$_3$ Emissions and Percentages by County and Source Category in the Illinois/Missouri St. Louis MSA in 2008 and 2011										
	2008 NH$_3$ Emissions (Tons/Year)					2011 NH$_3$ Emissions (Tons/Year)				
Missouri	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
St. Louis	720.41	1,036.69	582.99	7.33	**2,347.42**	666.26	718.37	369.32	7.46	**1,761.41**
	50.90%	8.51%	43.02%	36.28%	**15.68%**	54.31%	6.41%	38.09%	36.46%	**13.12%**
St. Louis City	568.40	129.50	169.20	2.21	**869.31**	514.75	148.42	94.89	1.47	**759.53**
	40.16%	1.06%	12.49%	10.94%	**5.81%**	41.96%	1.32%	9.79%	7.18%	**5.66%**
St. Charles	8.04	883.43	132.82	2.58	**1,026.87**	4.78	899.54	113.53	2.46	**1,020.31**
	0.57%	7.25%	9.80%	12.77%	**6.86%**	0.39%	8.02%	11.71%	12.02%	**7.60%**
Jefferson	8.97	165.26	90.42	1.06	**265.71**	7.61	175.35	66.35	1.03	**250.34**
	0.63%	1.36%	6.67%	5.25%	**1.77%**	0.62%	1.56%	6.84%	5.03%	**1.86%**
Franklin	2.82	1,300.09	77.75	1.74	**1,382.40**	3.07	1,265.49	43.05	1.23	**1,312.84**
	0.20%	10.67%	5.74%	8.61%	**9.23%**	0.25%	11.29%	4.44%	6.01%	**9.78%**
Lincoln	-	1,010.92	22.93	0.79	**1,034.64**	-	863.00	18.42	0.58	**882.00**
	0.00%	8.30%	1.69%	3.91%	**6.91%**	0.00%	7.70%	1.90%	2.83%	**6.57%**
Warren	0.77	681.24	28.70	0.34	**711.05**	-	647.55	21.77	0.32	**669.64**
	0.05%	5.59%	2.12%	1.68%	**4.75%**	0.00%	5.78%	2.25%	1.56%	**4.99%**
Missouri MSA	**1,309.41**	**5,207.13**	**1,104.81**	**16.05**	**7,637.40**	**1,196.47**	**4,717.72**	**727.33**	**14.55**	**6,656.07**
	92.52%	**42.75%**	**81.53%**	**79.43%**	**51.02%**	**97.53%**	**42.08%**	**75.01%**	**71.11%**	**49.56%**
	2008 NH$_3$ Emissions (Tons/Year)					2011 NH$_3$ Emissions (Tons/Year)				
Illinois	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
Clinton	0.33	3,124.86	16.84	0.48	**3,142.51**	0.31	2,995.71	14.31	0.64	**3,010.98**
	0.02%	25.66%	1.24%	2.36%	**20.99%**	0.03%	26.72%	1.48%	3.15%	**22.42%**
Jersey	-	546.91	8.09	0.25	**555.24**	-	490.11	7.36	0.39	**497.86**
	0.00%	4.49%	0.60%	1.24%	**3.71%**	0.00%	4.37%	0.76%	1.92%	**3.71%**
Madison	82.99	1,233.37	109.94	1.74	**1,428.04**	23.49	1,113.03	106.17	2.21	**1,244.90**
	5.86%	10.13%	8.11%	8.63%	**9.54%**	1.91%	9.93%	10.95%	10.79%	**9.27%**
Monroe	0.12	870.42	13.77	0.34	**884.65**	0.16	808.97	13.52	0.92	**823.57**
	0.01%	7.15%	1.02%	1.66%	**5.91%**	0.01%	7.21%	1.39%	4.49%	**6.13%**
St. Clair	22.43	1,196.94	101.72	1.35	**1,322.45**	6.29	1,087.04	100.90	1.75	**1,195.97**
	1.59%	9.83%	7.51%	6.66%	**8.83%**	0.51%	9.69%	10.41%	8.54%	**8.91%**
Illinois MSA	**105.87**	**6,972.50**	**250.36**	**4.16**	**7,332.89**	**30.25**	**6,494.86**	**242.25**	**5.91**	**6,773.28**
	7.48%	**57.25%**	**18.47%**	**20.57%**	**48.98%**	**2.47%**	**57.92%**	**24.99%**	**28.89%**	**50.44%**
MSA Total	**1,415.28**	**12,179.63**	**1,355.17**	**20.21**	**14,970.29**	**1,226.72**	**11,212.58**	**969.58**	**20.46**	**13,429.35**

* Note: The percentages listed in the table above indicate each area's percentage of the total IL/MO St. Louis MSA NH$_3$ emissions during the applicable year for the applicable source category.

3.2 Emission Source Location

Emissions source location is important to determine if particular sources are impacting the concentrations at violating monitoring sites. Figure 3 provides a map with point sources in the Illinois/Missouri St. Louis MSA along with the location of the Granite City monitor. The map also includes one source located in the Baldwin Township of Randolph County, Illinois because this area was included in the 1997 St. Louis IL/MO $PM_{2.5}$ nonattainment area, and there is a significant emissions source located here. Each of the sources included in Figure 3 are numbered. These numbers correspond to the sources, which are listed according to these numbers in Table 8 along with the numeric emissions in 2011 for each of these sources. Table 8 also provides the distance in miles from each of these sources to the Granite City monitor.

Sources on the map include point sources with emissions in 2011 of 100 or more tons of direct $PM_{2.5}$ or any individual $PM_{2.5}$ precursor. The sources are sized by the total sum of all direct $PM_{2.5}$ and $PM_{2.5}$ precursor emissions in 2011. The smaller points indicate sources with fewer emissions, while the larger points on the map indicate sources with higher emissions as indicated in the legend. Missouri sources are shown in red on the map, while Illinois sources are shown in blue. The green dot on the map indicates the location of the Granite City monitor. Figure 4 provides a map with the same sources as Figure 3, but breaks the emissions from these sources into pollutant categories in order to show the specific pollutant(s) that is relevant to each source.

Figure 3

MO - IL 1997 PM 2.5 Nonattainment Area with Sources Sized by Sum of Total 2011 Direct and Precursor PM 2.5 Emissions (NH_3, NO_x, PM 2.5, SO_2, VOC) With Granite City Monitor

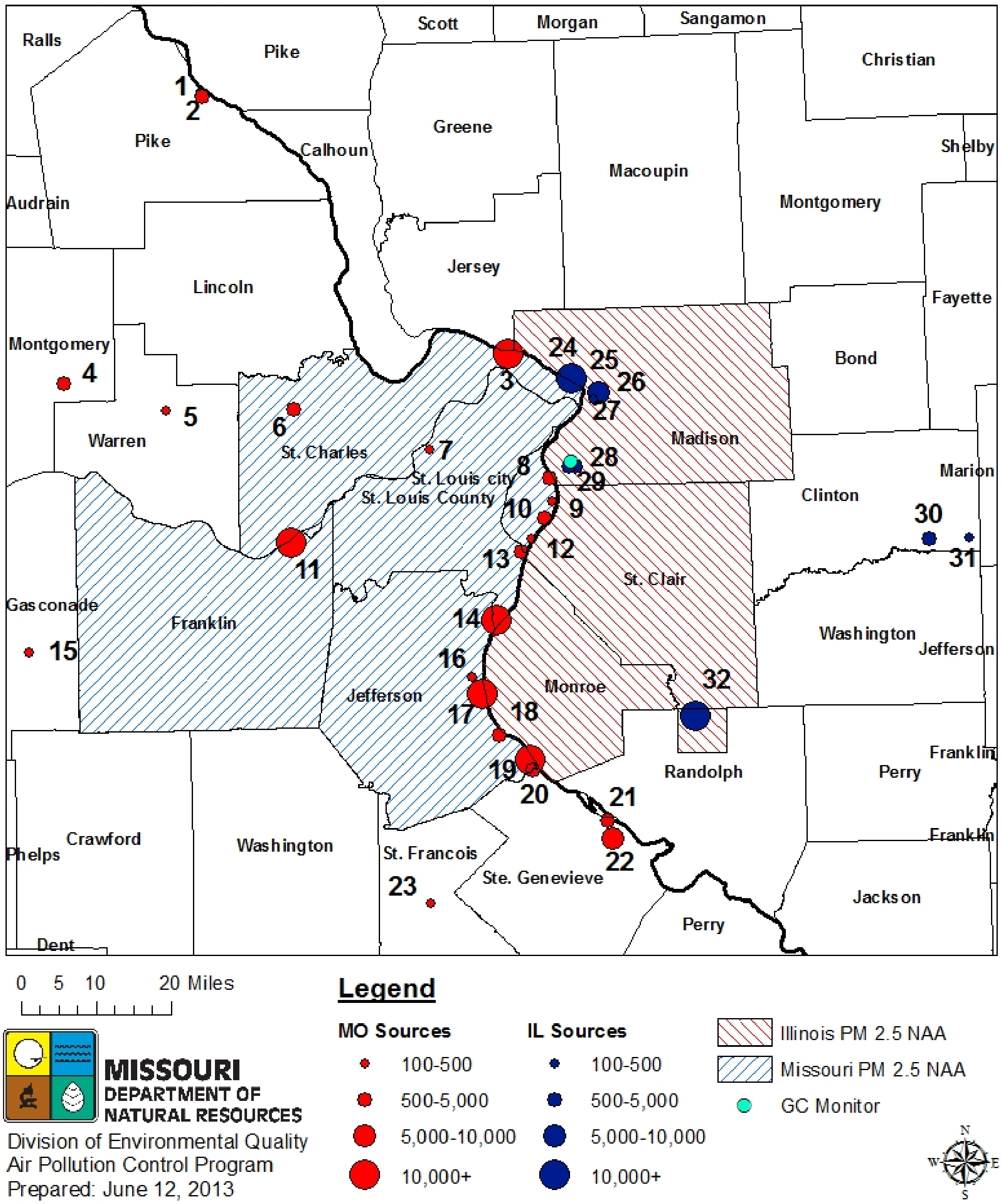


Figure 4

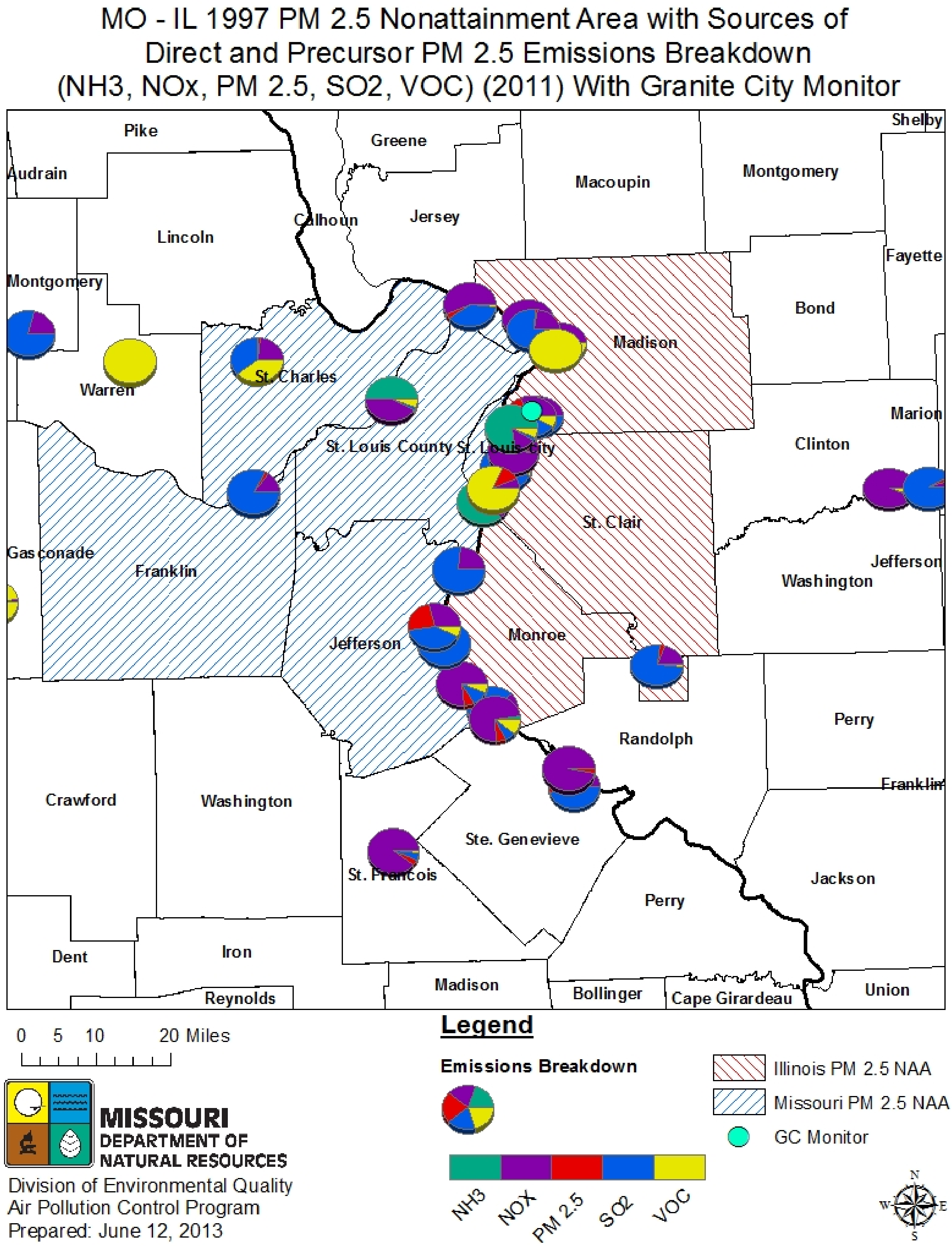

MO - IL 1997 PM 2.5 Nonattainment Area with Sources of
Direct and Precursor PM 2.5 Emissions Breakdown
(NH3, NOx, PM 2.5, SO2, VOC) (2011) With Granite City Monitor
Pike
Greene
Shelby
Audrain
Macoupin
Montgomery
Calhoun
Jersey
Lincoln
Fayette
Montgomery
Bond
Madison
St. Charles
Warren
Marion
St. Louis County
St. Louis City
Clinton
St. Clair
Gasconade
Franklin
Jefferson
Washington
Jefferson
Monroe
Perry
Randolph
Franklin
Crawford
Washington
Ste. Genevieve
St. Francois
Jackson
Perry
Dent
Iron
Madison
Bollinger
Cape Girardeau
Union
Reynolds
0 5 10 20 Miles
Legend
Emissions Breakdown
NH3
NOX
PM 2.5
SO2
VOC
Illinois PM 2.5 NAA
Missouri PM 2.5 NAA
GC Monitor
MISSOURI DEPARTMENT OF NATURAL RESOURCES
Division of Environmental Quality
Air Pollution Control Program
Prepared: June 12, 2013

Table 8	2011 Facility Level $PM_{2.5}$ and $PM_{2.5}$ Precursor Emissions (tons/year) from Significant Point Sources in the St. Louis Area (Sources with 100 + annual tons of emissions of Direct $PM_{2.5}$ or any Individual $PM_{2.5}$ Precursor) *							
Missouri Facilities								
Figure 3 Map Number	**County Name**	**Facility Name**	**NH_3**	**NO_X**	**PM_{25}-PRI**	**SO_2**	**VOC**	**Distance to Granite City Monitor (mi.)**
1	Pike	ASHLAND INC-MISSOURI CHEMICAL WORKS	2.68	295.33	7.67	1,835.56	58.76	69.32
			0.19%	0.65%	0.14%	0.81%	0.62%	
2	Pike	DYNO NOBEL INC-LOMO PLANT	20.59	462.41	52.99	0.02	0.16	69.32
			1.45%	1.02%	0.98%	0.00%	0.00%	
3	St. Charles	AMEREN MISSOURI-SIOUX PLANT	0.8	7,073.99	413.53	4,899.10	156.51	16.61
			0.06%	15.54%	7.62%	2.16%	1.66%	
4	Montgomery	CHRISTY MINERALS, LLC-HIGH HILL	-	147.7	0.1	549.5	-	68.45
			-	0.32%	0.00%	0.24%	-	
5	Warren	CASCADES PLASTICS INC-WARRENTON	-	-	-	-	163.27	54.5
			-	-	-	-	1.73%	
6	St. Charles	GENERAL MOTORS LLC-WENTZVILLE CENTER	0.31	270.5	26.16	424.24	480.06	37.64
			0.02%	0.59%	0.48%	0.19%	5.08%	
7	St. Louis	MSD, MISSOURI RIVER WWTP-MO RIVER WASTERWATER TREATMENT PLANT	103.16	89.32	0.27	3.66	11.12	19.10
			7.29%	0.20%	0.00%	0.00%	0.12%	
8	St. Louis city	METROPOLITAN ST. LOUIS SEWER DISTRICT-BISSELL POINT WWTP	476.95	80.58	3.44	15.47	40.2	3.67
			33.70%	0.18%	0.06%	0.01%	0.43%	
9	St. Louis city	HERTZ ST. LOUIS ONE, LLC-LACLEDE GAS BUILDING	-	197.05	1.68	0.05	2.57	5.98
			-	0.43%	0.03%	0.00%	0.03%	
10	St. Louis city	ANHEUSER-BUSCH INC-ST. LOUIS	31.8	467.42	158.07	2,998.41	215.07	8.40
			2.25%	1.03%	2.91%	1.32%	2.27%	
11	Franklin	AMEREN MISSOURI-LABADIE PLANT	3.04	9,891.46	1,712.14	57,948.81	323.15	39.00
			0.21%	21.73%	31.53%	25.51%	3.42%	
12	St. Louis city	JW ALUMINUM-ST. LOUIS	-	21.63	36.66	0.16	275.68	11.65
			0.00%	0.05%	0.68%	0.00%	2.92%	
13	St. Louis	METROPOLITAN ST. LOUIS SEWER DISTRICT-LEMAY WWTP	467.9	44.39	1.6	1.78	16.11	13.82
			33.06%	0.10%	0.03%	0.00%	0.17%	
14	St. Louis	AMEREN MISSOURI-MERAMEC PLANT	1.13	4,789.24	171.93	15,281.50	105.65	23.42
			0.08%	10.52%	3.17%	6.73%	1.12%	
15	Gasconade	RR DONNELLEY - OWENSVILLE-OWENSVILLE	0.06	1.84	0.14	0.01	122.75	76.82
			0.00%	0.00%	0.00%	0.00%	1.30%	
16	Jefferson	SAINT-GOBAIN CONTAINERS INC-PEVELY	-	107.22	87.02	149.07	26.35	31.66
			-	0.24%	1.60%	0.07%	0.28%	

Missouri Facilities continued...								
Figure 3 Map Number	County Name	Facility Name	NH_3	NO_X	PM_{25}-PRI	SO_2	VOC	Distance to Granite City Monitor (mi.)
17	Jefferson	DOE RUN COMPANY-HERCULANEUM SMELTER	0.29	9.6	4.35	15,234.49	1.71	33.22
			0.02%	0.02%	0.08%	6.71%	0.02%	
18	Jefferson	RIVER CEMENT CO. DBA BUZZI UNICEM USA-SELMA PLANT	5.85	2,029.21	168.35	282.62	151.57	37.71
			0.41%	4.46%	3.10%	0.12%	1.60%	
19	Jefferson	AMEREN MISSOURI-RUSH ISLAND PLANT	1.4	3,441.72	246.31	28,035.57	149.11	40.16
			0.10%	7.56%	4.54%	12.34%	1.58%	
20	Ste. Genevieve	HOLCIM (US) INC-STE. GENEVIEVE PLANT	54.27	1,975.59	194.9	170.63	279.9	41.52
			3.83%	4.34%	3.59%	0.08%	2.96%	
21	Ste. Genevieve	LHOIST NORTH AMERICA OF MISSOURI-STE. GENEVIEVE	-	1,262.89	36.64	9.98	7.77	48.07
			-	2.77%	0.67%	0.00%	0.08%	
22	Ste. Genevieve	MISSISSIPPI LIME COMPANY-STE. GENEVIEVE	0.01	3,630.42	576.67	3,536.37	53.79	50.54
			0.00%	7.98%	10.62%	1.56%	0.57%	
23	St. Francois	PIRAMAL GLASS USA INC-PARK HILLS	3.31	363.23	15.88	19.01	6.27	61.75
			0.23%	0.80%	0.29%	0.01%	0.07%	

Illinois Facilities								
Figure 3 Map Number	County Name	Facility Name	NH_3	NO_X	PM_{25}-PRI	SO_2	VOC	Distance to Granite City Monitor (mi.)
24	Madison	Alton Steel Inc.	0.71	131.94	9.14	45.9	3.99	12.34
			0.05%	0.29%	0.17%	0.02%	0.04%	
25	Madison	Dynegy Midwest Generation Inc.	0.62	2,490.76	172.51	8,556.18	60.26	11.00
			0.04%	5.47%	3.18%	3.77%	0.64%	
26	Madison	ConocoPhillips Co	0.17	2,909.80	209.09	1,814.49	1,844.48	9.89
			0.01%	6.39%	3.85%	0.80%	19.51%	
27	Madison	Explorer Pipeline Co	-	-	-	-	120.96	8.79
			-	-	-	-	1.28%	
28	Madison	Gateway Energy & Coke Co LLC	-	406.73	69.46	1,201.41	10.57	0.73
			-	0.89%	1.28%	0.53%	0.11%	
29	Madison	US Steel Granite City	9.07	1,188.86	747.65	1,430.43	293.06	0.82
			0.64%	2.61%	13.77%	0.63%	3.10%	
30	Clinton	Natural Gas Pipeline Co of America	0.09	2,989.76	35.72	0.45	170.05	48.78
			0.01%	6.57%	0.66%	0.00%	1.80%	
31	Clinton	W G Murray Development Center	-	22.79	11.54	355.47	0.16	53.98
			-	0.05%	0.21%	0.16%	0.00%	
32	Randolph	Dynegy Midwest Generation Inc.	128.84	4,771.57	941.17	19,066.03	353.63	37.77
			9.10%	10.48%	17.33%	8.39%	3.74%	

* Note: The percentages listed above indicate each source's percentage of the total 2011 point source emissions in the IL/MO St. Louis MSA for the applicable pollutant.

3.3 Local Emissions Sources in Granite City, Illinois

Figure 5 displays a satellite image of the Granite City area. This map shows the location of the Gateway Energy and Coke Company LLC facility (property boundary outlined in blue) along with the US Steel Granite City facility (property boundary outlined in red) with their proximity to the violating Granite City monitor. As depicted in the map, these two sources are each located less than one mile from the Granite City monitor, with U.S. Steel's operations wrapping around the monitor to the southeast, south, and southwest, and Gateway Energy Coke Company located less than one mile to the southeast of the monitor. The geographic location of these two sources relative to the Granite City monitor will be considered along with meteorology data in the next Section.

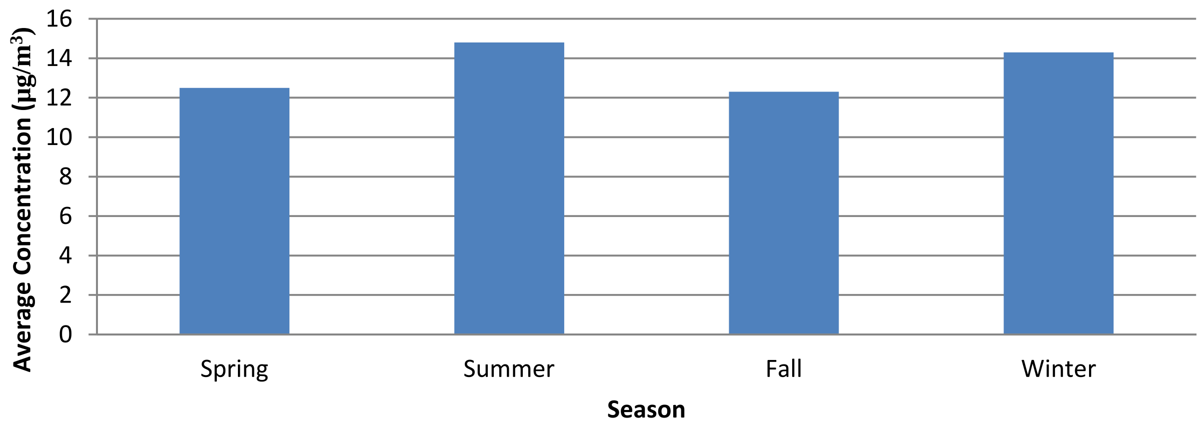
Figure 5 Satellite Image of the Granite City Monitor with Significant Local Emissions Sources' Property Boundaries

4. Meteorology Data

4.1 Seasonal Variation

In an effort to more fully understand the impacts that meteorology has on $PM_{2.5}$ concentrations at this site, the Air Program analyzed the seasonal average $PM_{2.5}$ concentrations at the Granite City monitor from 2010 – 2012. For the purposes of this analysis, the months of December – February were considered winter months, the months of March – May were considered spring months, the months of June – August were considered summer months, and the months of September – November were considered fall months. Figure 6 displays the average seasonal $PM_{2.5}$ concentrations at the Granite City monitor from 2010 – 2012. As can be seen, during the winter and summer months $PM_{2.5}$ concentrations averaged over 14 micrograms/cubic meter (µg/m^3), and during the spring and fall months the $PM_{2.5}$ concentrations averaged just over 12 µg/m^3. Therefore, the meteorological conditions during the summer and winter are slightly more conducive to higher $PM_{2.5}$ concentrations in Granite City than meteorological conditions during the spring and fall. However, as indicated in Figure 6, the average $PM_{2.5}$ concentrations at the Granite City monitor from 2010 - 2012, are above the level of the NAAQS in all four seasons, and therefore any analysis of $PM_{2.5}$ concentrations or contributing sources at this site must take into consideration a full year's worth of data.

Figure 6 Granite City Average $PM_{2.5}$ Concentrations by Season (2010 - 2012)



4.2 Wind Rose Data

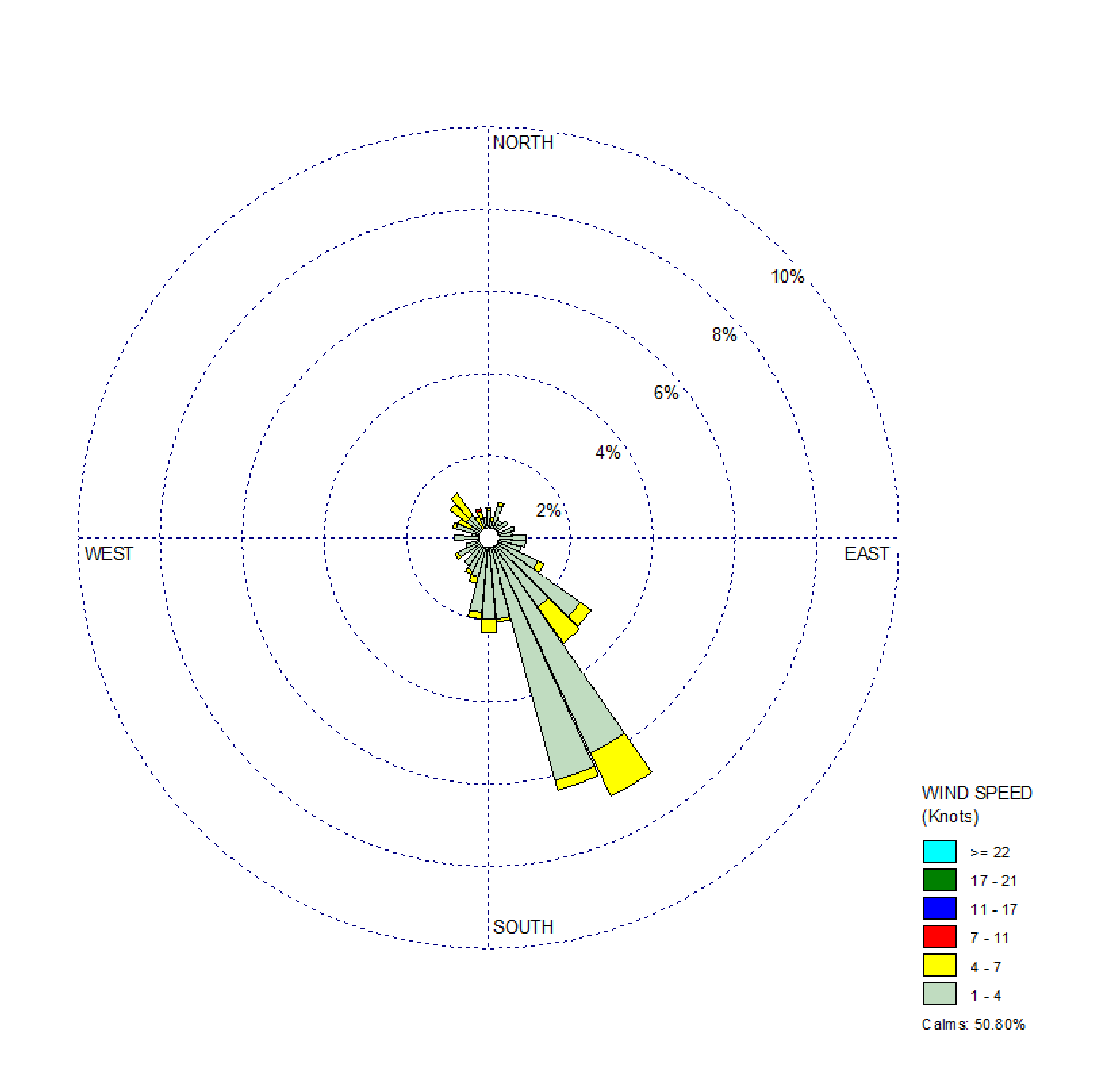
The next step in the evaluation was to determine the emission source origins on days with high and low $PM_{2.5}$ concentrations at the Granite City monitor. For each date in Table 1, hourly wind speed and direction data was gathered from the International Airport Weather Station at the St. Louis Regional Airport in Cahokia, IL. Figure 7 displays the wind rose for all of the hours in the days where the Granite City monitor recorded its highest 5 percent $PM_{2.5}$ concentrations during the years 2010 – 2012. As seen in Figure 7, calms represent 50% of the hours during the high days at the Granite City monitor for the years evaluated. These calm winds indicate that emissions from local sources are not dissipating from the area and are most likely impacting the monitored $PM_{2.5}$ concentrations significantly. Nearly all of the remaining hours are associated with low wind speeds coming from the south and southeast. As shown in Figure 5, there are two point sources with significant direct $PM_{2.5}$ emissions located within one mile of the Granite City monitor. These two sources surround the area southwest, south, and southeast of the monitor. The proximity of these two sources to the Granite City monitor combined with the calm and low speeds coming from the south and southeast indicates that $PM_{2.5}$ concentrations in the area are likely greatly impacted by these two sources. This conclusion is further investigated and supported in Section 5, where daily monitoring values at locations upwind and downwind of the two sources in Granite City are evaluated on these same days.

In an effort to further understand the cause of elevated concentrations at the Granite City monitor, the wind directions were also evaluated on days where Granite City recorded its lowest $PM_{2.5}$ concentrations. Figure 8 displays the wind rose for all of the hours in the days where the Granite City monitor recorded its lowest 5 percent $PM_{2.5}$ concentrations during the years 2010 – 2012. As seen in Figure 8, calms only represented 10% of the hours during these days and virtually all of the lowest concentrations of $PM_{2.5}$ at Granite City are associated with higher wind speeds blowing from the Northwest quadrant. Looking on the map, the counties located to the northwest of the Granite City monitor include the northern part of St. Louis city, St. Louis County, and St. Charles County. However, of greater relevance is the fact that when wind is blowing from the northwest, the Granite City monitor is upwind of the two point sources in Illinois located within one mile to the south of the monitor. Thus, when winds are blowing emissions from these two sources away from the monitor, it results in the lowest $PM_{2.5}$ concentrations recorded at the site. This supports the conclusion that the elevated concentrations recorded at this site are the result of these two sources, and that Missouri sources are not likely contributing to the violation at this monitor.

Figure 7 Wind Directions and Speeds for All Hours of the Day on High $PM_{2.5}$ Concentration Days at Granite City in 2010 – 2012

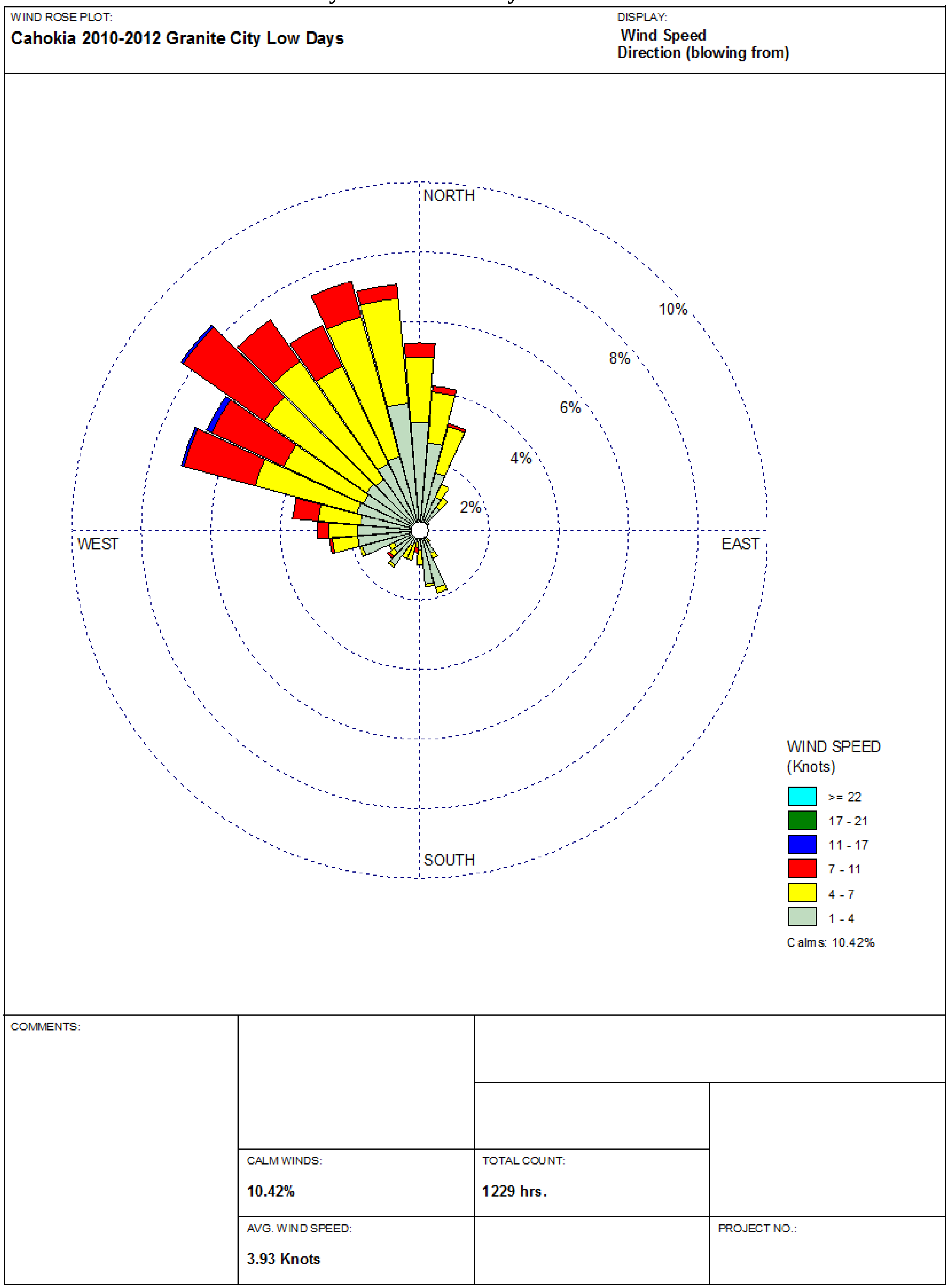
WIND ROSE PLOT:
Cahokia 2010-2012 Granite City High Days

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:	CALM WINDS: **50.80%**	TOTAL COUNT: **1211 hrs.**
	AVG. WIND SPEED: **1.22 Knots**	PROJECT NO.:

Figure 8 Wind Directions and Speeds for All Hours of the Day on Low $PM_{2.5}$ Concentration Days at Granite City in 2010 – 2012



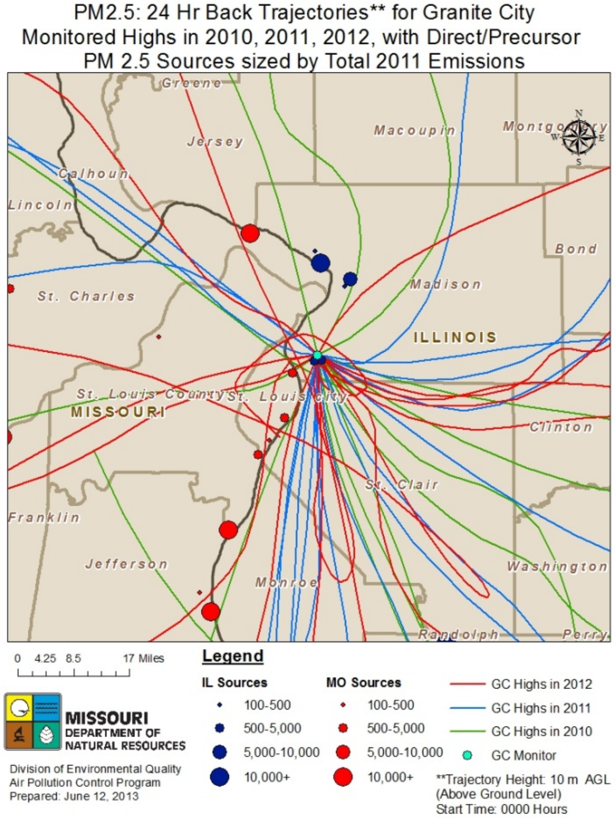
4.3 HYSPLIT Modeling

The Air Program also evaluated 24-hour back trajectories of the air masses on both the high days and low days recorded at the Granite City monitor from 2010 – 2012. In order to perform this analysis, the back trajectories were generated with the Hybrid Single Particle Lagrangian Integrated Trajectory Model (HYSPLIT). This model is capable of back casting the path that an air mass traveled through prior to arriving at a specific location at a specific point in time. HYSPLIT was used to generate the paths that the air masses came from at the beginning, middle, and end of each day listed in Table 1. It is important to note, that HYSPLIT generates the wind trajectory for a parcel of air at a specific location for one specific point in time. By using HYSPLIT to generate the back trajectories for these three times of the day and considering them all together, it can help determine how air masses were moving over the region during the episode days evaluated. However, because the $PM_{2.5}$ concentrations evaluated are based on a 24-hour average, back casting the wind trajectories from these three specific points in time during the episode days does not necessarily capture the specific path that the air mass traveled prior to the specific point in time of each day when $PM_{2.5}$ concentrations were at their peak.

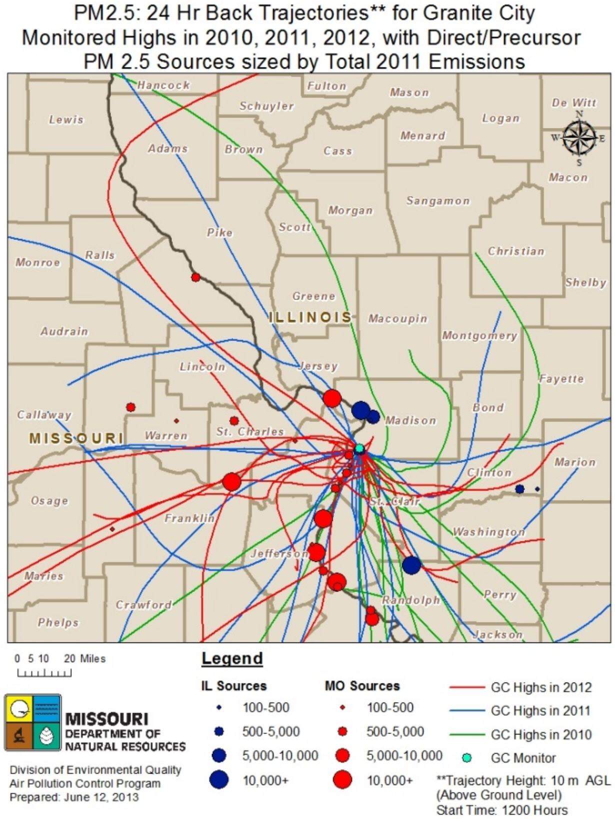
Figures 9 and 10 give the back trajectories at 12:00 in the morning, 12:00 noon, and 11:00 p.m. for each of the high $PM_{2.5}$ and low $PM_{2.5}$ days respectively, as listed in Table 1. These figures also display the largest point sources located in the Illinois/Missouri MSA along with the location of the Granite City Monitor for reference. As seen in Figure 9, from 2010 – 2012 the high days are generally associated with air masses traveling from the Southeast and passing over the two Illinois point sources located nearby to the southwest and southeast of the Granite City monitor. It is noted that on a few of the high days, HYSPLIT indicates that air masses were traveling from the southwest and passed over Missouri sources along the Mississippi River on the days in question. However, when winds are blowing out of the southwest, the air masses always pass over the Illinois source located just southwest of the Granite City monitor (U.S. Steel), thus increasing the $PM_{2.5}$ concentration levels of the air mass before they reach the Granite City monitor. Furthermore, as can be seen in Figure 10, from 2010 – 2012 the low days are generally associated with air masses traveling from the Northwest, much of the time passing directly over the northern Missouri portion of the St. Louis MSA, which aligns with the data from the wind rose in Figure 8. Also, as noted above, it is less relevant to analyze where the winds are coming from on low $PM_{2.5}$ concentration days than it is to analyze and understand where they are not coming from on those same days. Just as is indicated by the wind rose data, the HYSPLIT trajectories on the low days show that $PM_{2.5}$ concentrations recorded at the Granite City monitor are lowest when the wind is blowing emissions from the two nearby Illinois sources away from the monitor. Further supporting this conclusion is the fact that there is a cluster of four significant point sources located in Illinois only 10 – 20 miles north of the Granite City monitor, and yet the air masses only pass through this cluster of sources on one (1) or two (2) of high $PM_{2.5}$ concentration days, while the air masses do pass over these sources on a substantial amount of the low $PM_{2.5}$ concentration days at the Granite City monitor. This supports the conclusion that the two sources surrounding the southeast, south, and southwest of the monitor are the controlling factors in the elevated $PM_{2.5}$ concentrations at this site. The meteorology data for both the high $PM_{2.5}$ concentration days and the low $PM_{2.5}$ concentration days supports the conclusion that Missouri sources are not contributing to the violation at the Granite City monitor.

Figure 9 HYSPLIT Wind Trajectories for High $PM_{2.5}$ Concentration Days at Granite City in 2010 – 2012 (12:00 a.m., 12:00 p.m., and 11:00 p.m.)

12:00 a.m. (Morning)



12:00 p.m. (Noon)



11:00 p.m.

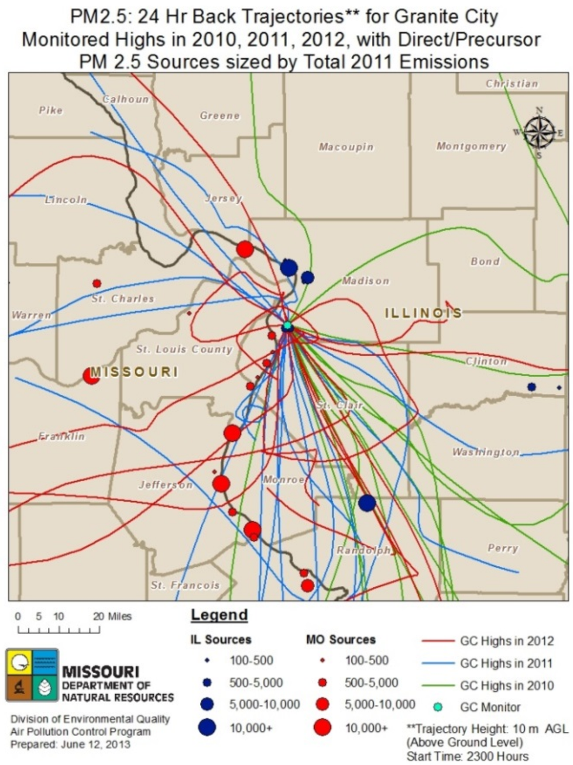
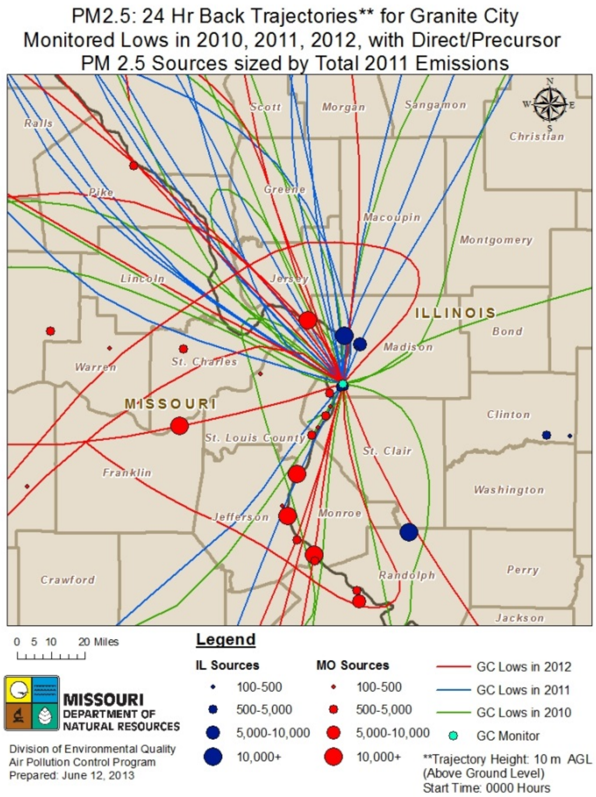
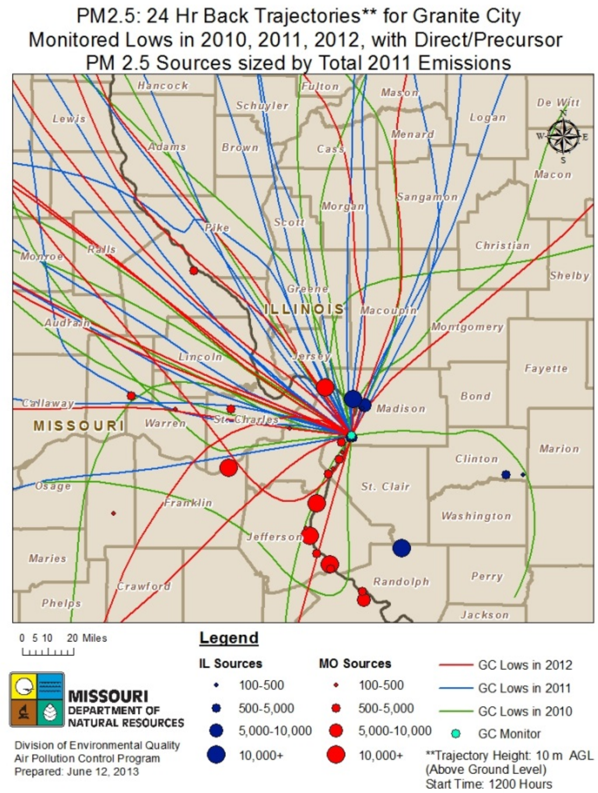


Figure 10 HYSPLIT Wind Trajectories for Low $PM_{2.5}$ Concentration Days at Granite City in 2010 – 2012 (12:00 a.m., 12:00 p.m., and 11:00 p.m.)

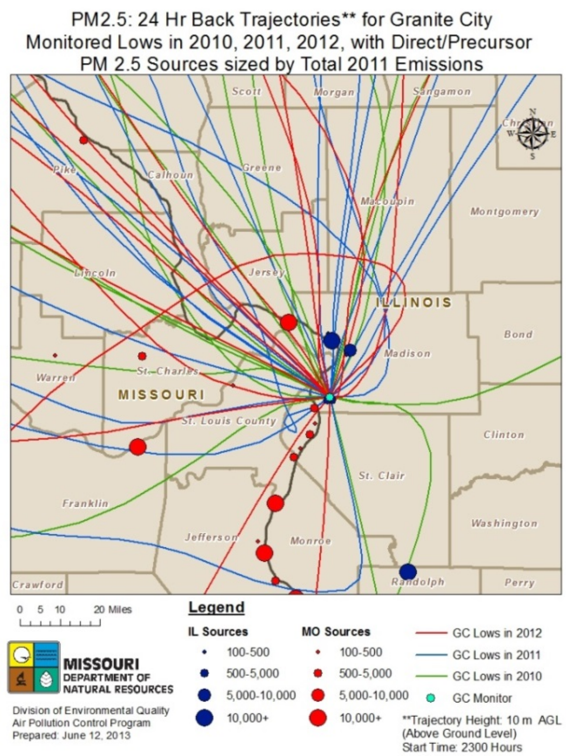
12:00 a.m. (Morning)



12:00 p.m. (Noon)



11:00 p.m.



5. Comparison of $PM_{2.5}$ Concentrations at Blair Street and Granite City

5.1 Comparison of 24-hour $PM_{2.5}$ Concentrations

Table 9 displays the distance in miles between each of the St. Louis area monitors included in Figure 1. As seen in the table, the Blair Street Monitor and the Granite City monitor are 4.6 miles apart. It would be expected that due to the proximity of these two monitors, they would monitor very similar $PM_{2.5}$ concentrations from day to day unless immediate local sources of direct $PM_{2.5}$ or $PM_{2.5}$ precursors are impacting one monitor but not the other. It has already been established in Section 4 of this Appendix that calm and low wind speeds are associated with high $PM_{2.5}$ concentrations in Granite City, which indicates that local emissions sources are responsible for the elevated $PM_{2.5}$ concentrations being recorded by this monitor.

Depending on wind direction, the Blair Street monitor provides relevant upwind or downwind concentrations that can be used for comparison against the concentrations recorded at the Granite City, Illinois site. The Air Program retrieved the 24-hour $PM_{2.5}$ concentrations at the Blair Street and Granite City monitors for the top 5 percent episode days listed in Table 1 and compared these values, which are listed below in Tables 10, 11, and 12 for the years 2010, 2011, and 2012, respectively. As can be seen, the 24-hour values at the highest 5 percent episode days at the Granite City are roughly 10% – 15% higher on average than the 24-hour values recorded at the Blair Street site on those same days. In fact, on a few select days, the concentrations at Granite City are 25% - 100% higher than the concentrations recorded at Blair Street, which have been highlighted in Tables 10 – 12. These outlier days, where the concentrations at Granite City far exceed those recorded at Blair Street, drive the design value at Granite City much higher than it is across the rest of the St. Louis Region. For this reason, wind rose and HYSPLIT trajectory runs were developed for these specific outlier days in an effort to determine the conditions and sources that might be causing these localized episodes that drive the Granite City monitor's design value higher than all other monitors across the St. Louis Region. Figures 11 and 12 display the wind rose and HYSPLIT results, respectively, for these outlier days at Granite City.

As noted in Section 4, the HYSPLIT and wind rose data evaluated indicates that nearly all of the days where the highest $PM_{2.5}$ concentrations were recorded at the Granite City monitor are associated with low to calm wind speeds and air masses traveling from southeast, south, and southwest of the monitor. Monitoring values on these same days average 10% – 15% higher in Granite City when compared to Blair Street. The conclusion is that source(s) located downwind of the Blair Street monitor but upwind of the Granite City monitor are contributing to the Granite City concentrations on the highest $PM_{2.5}$ concentration days, causing $PM_{2.5}$ concentrations in Granite City to exceed the levels experienced across the rest of the St. Louis urban core on these same days. The meteorology data analyzed for the outlier days suggests that when wind speeds are low and air masses are not being transported across the river from either direction, $PM_{2.5}$ concentrations in Granite City are much higher than concentrations experienced only 4.6 miles away at Blair Street just across the river. This is further evidence that the local sources surrounding the Granite City monitor are the predominant cause of a handful of high episode days in Granite City. Further support for these conclusions is discussed below in Subsection 5.3 showing that the average $PM_{2.5}$ concentration is below the level of the 2012 NAAQS during the year in which the U.S. Steel Mill was shutdown, yet above the level of the standard in all other years evaluated.

Table 9.	Distance Between Monitors in Miles (St. Louis Area $PM_{2.5}$ Monitoring Network)								
Site Name:	**Arnold West**	**South Broadway**	**Blair Street**	**Branch Street**	**Ladue**	**Alton**	**Wood River**	**East St. Louis**	**Granite City**
Arnold West	X	9.77	17.97	18.26	14.15	34.26	32.54	17.13	22.54
South Broadway	9.77	X	8.61	8.82	8.79	25.72	23.55	7.36	13.04
Blair Street	17.97	8.61	X	0.47	8.22	17.28	14.95	3.7	4.6
Branch Street	18.26	8.82	0.47	X	8.7	17.21	14.8	3.45	4.28
Ladue	14.15	8.79	8.22	8.7	X	20.73	19.63	10.61	12
Alton	34.26	25.72	17.28	17.21	20.73	X	3.55	20.11	13.7
Wood River	32.54	23.55	14.95	14.8	19.63	3.55	X	17.41	10.93
East St. Louis	17.13	7.36	3.7	3.45	10.61	20.11	17.41	X	6.48
Granite City	22.54	13.04	4.6	4.28	12	13.7	10.93	6.48	X

Table 10.	Top 5% Days for Granite City vs. Same Day Value for Blair (2010) *	
Date	**Granite City 24-Hour Concentration (µg/m³)**	**Blair 24-Hour Concentration (µg/m³)**
3/9/2010	39.0	24.1
2/4/2010	38.1	41.8
2/3/2010	32.4	34.6
8/8/2010	31.9	31.0
12/19/2010	30.0	26.1
1/15/2010	29.3	29.9
12/20/2010	29.2	18.6
8/7/2010	28.8	26.8
1/16/2010	28.4	26.5
12/28/2010	28.1	22.0
2/21/2010	27.8	31.6
4/13/2010	26.7	15.9
1/23/2010	26.2	13.6
8/9/2010	26.1	23.1
12/10/2010	26.1	23.0
12/9/2010	25.9	23.0
3/8/2010	25.4	26.8
Average Value for top 5% at Granite City	**29.4**	**25.8**

* Note: All values have been rounded to the nearest 0.1 µg/m³

** Note: Outlier days, where the Granite City monitor's 24-hour average concentration is at least 25% higher than the concentration recorded at Blair Street

Table 11. Top 5% Days for Granite City vs. Same Day Value for Blair (2011) *		
Date	Granite City 24-Hour Concentration (μg/m^3)	Blair 24-Hour Concentration (μg/m^3)
1/28/2011	37.1	35.7
1/17/2011	35.1	31.2
7/16/2011	34.3	31.2
6/8/2011	31.0	24.9
2/4/2011	30.8	25.7
1/24/2011	30.2	29.6
1/27/2011	27.9	24.5
6/9/2011	27.3	26.0
1/25/2011	27.1	29.7
6/3/2011	26.7	24.4
1/18/2011	26.4	24.0
3/31/2011	26.3	26.0
9/2/2011	26.3	21.9
8/2/2011	25.5	25.0
6/7/2011	25.4	18.7
6/4/2011	25.1	23.1
8/1/2011	24.9	20.7
5/10/2011	24.5	21.7
Average Value for top 5% at Granite City	**28.4**	**25.8**

* Note: All values have been rounded to the nearest 0.1 μg/m^3

** Note: Outlier days, where the Granite City monitor's 24-hour average concentration is at least 25% higher than the concentration recorded at Blair Street are highlighted in yellow

Table 12. Top 5% Days for Granite City vs. Same Day Value for Blair (2012) *		
Date	Granite City 24-Hour Concentration (μg/m^3)	Blair 24-Hour Concentration (μg/m^3)
11/17/2012	35.0	31.5
11/21/2012	34.5	32.7
11/18/2012	28.0	23.6
7/4/2012	27.3	24.1
12/24/2012	26.8	25.5
6/29/2012	26.2	19.4
7/2/2012	25.8	21.6
11/28/2012	25.5	18.1
2/17/2012	24.6	15.3
11/20/2012	24.6	21.1
9/6/2012	24.3	10.1
11/16/2012	24.2	27.5
6/30/2012	23.6	21.0
7/7/2012	23.4	20.4
1/10/2012	23.3	22.0
4/2/2012	23.0	17.6
11/15/2012	23.0	27.3
Average Value for top 5% at Granite City	**26.1**	**22.3**

* Note: All values have been rounded to the nearest 0.1 μg/m^3

** Note: Outlier days, where the Granite City monitor's 24-hour average concentration is at least 25% higher than the concentration recorded at Blair Street

Figure 11 **Wind Directions and Speeds for All Hours of the Day on Outlier $PM_{2.5}$ Concentration Days at Granite City in 2010 – 2012**

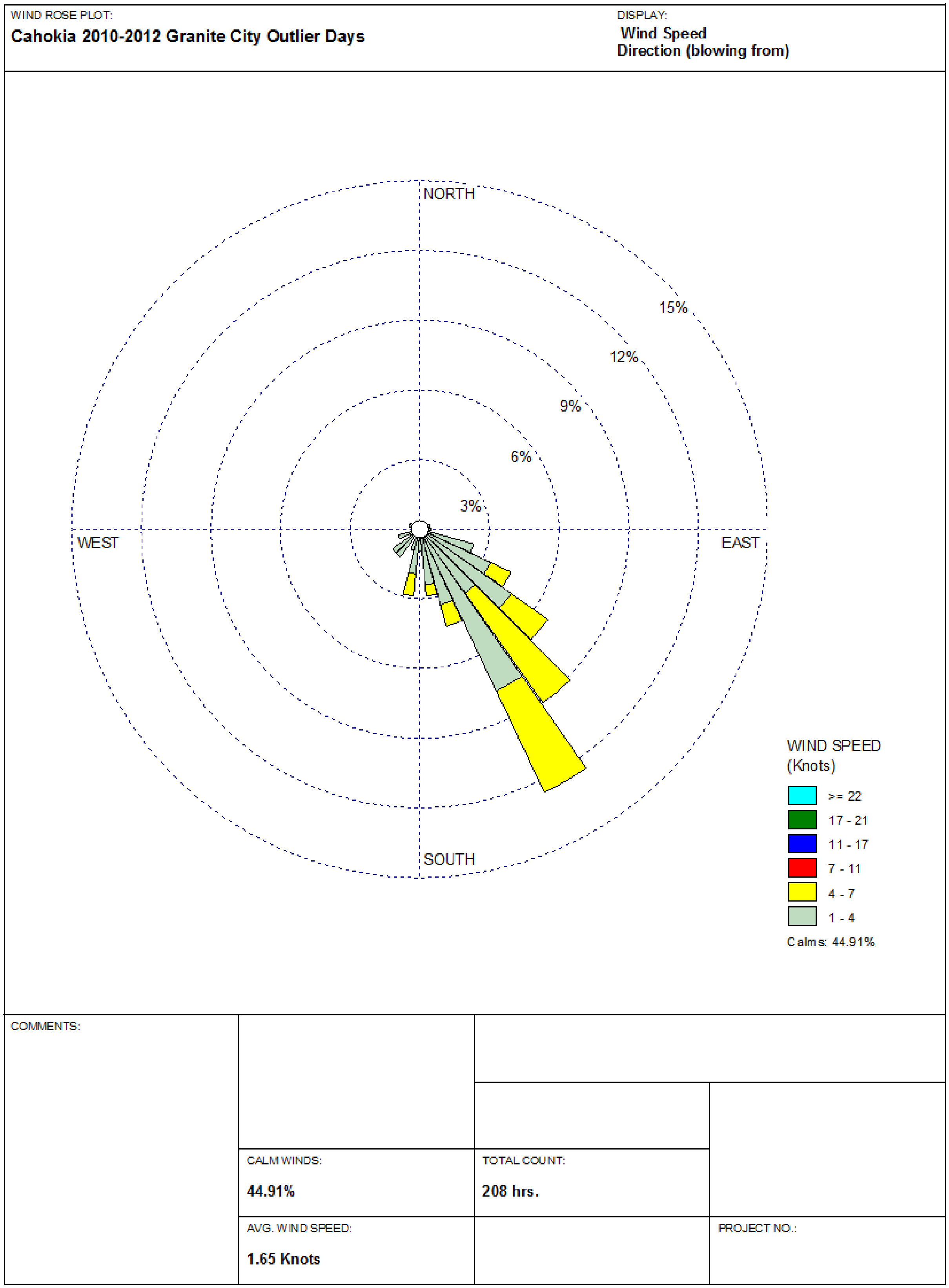
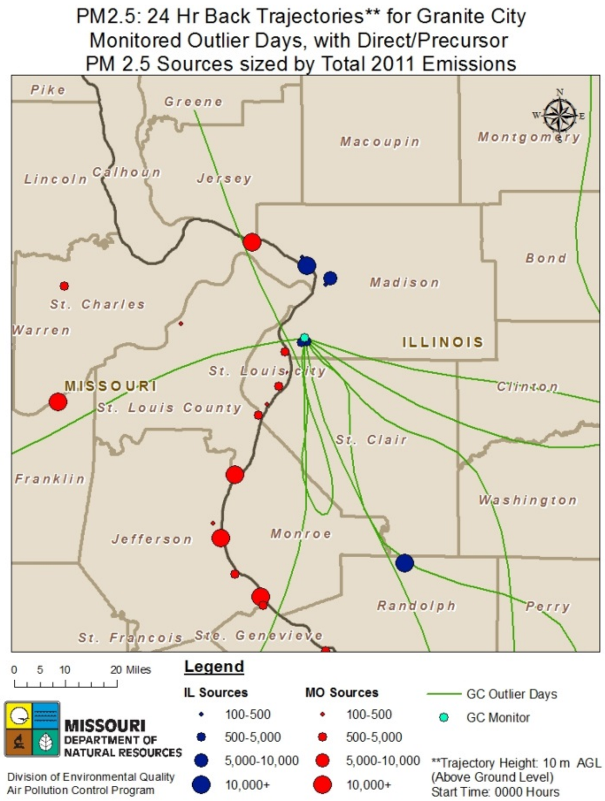
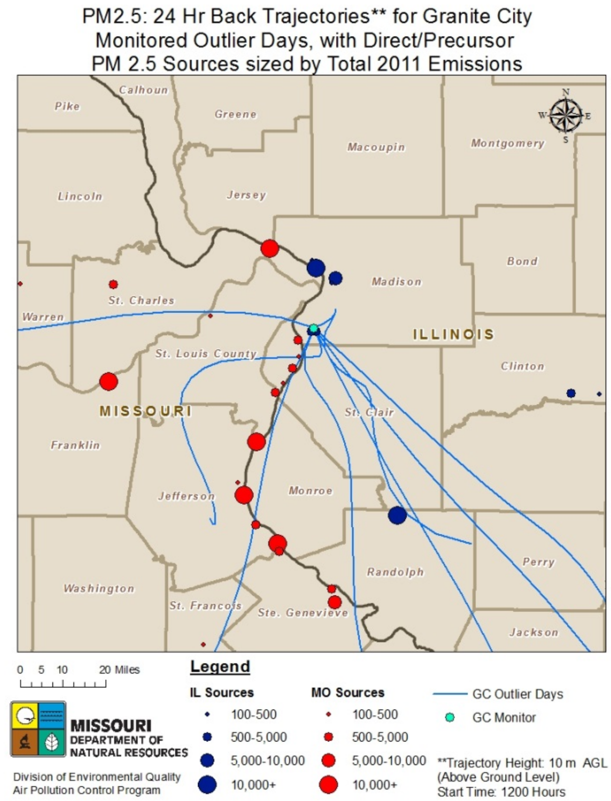


Figure 12 HYSPLIT Wind Trajectories for Outlier $PM_{2.5}$ Concentration Days at Granite City in 2010 – 2012 (12:00 a.m., 12:00 p.m., and 11:00 p.m.)

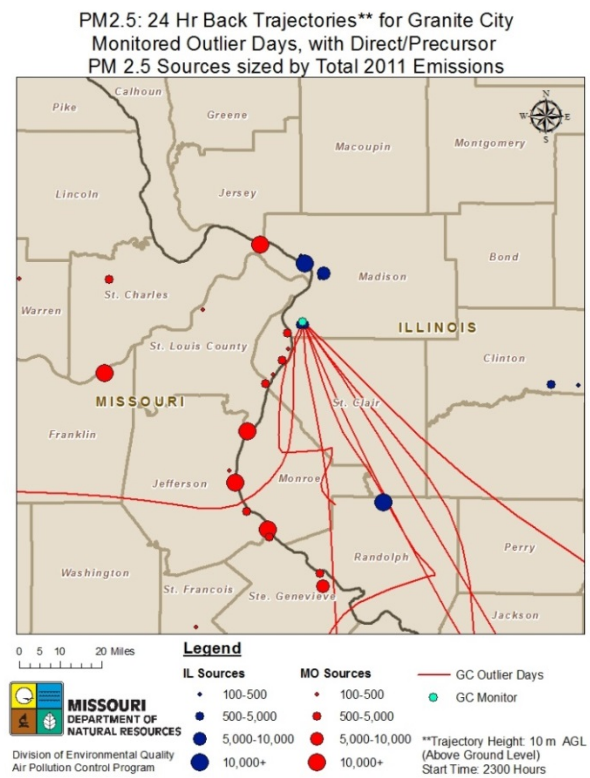
12:00 a.m. (Morning)



12:00 p.m. (Noon)



11:00 p.m.



5.2 Speciation Data Analysis at Blair Street and Granite City

As noted in Section 3, emissions of SO_X and NO_X from electric generating units, and their impact on $PM_{2.5}$ concentrations, have typically been controlled in the past through regional emissions programs. Per analyses performed by EPA when developing the Clean Air Interstate Rule:

> *For our analysis of States' ability to attain the $PM_{2.5}$ standards, we developed a group of emissions reduction measures for SO_2, NO_X, direct $PM_{2.5}$, and volatile organic compounds (VOC) as a surrogate for measures that States would potentially implement prior to 2009 in an effort to reach attainment. The measures address a broad range of source types. We analyzed the effect of applying this group of local controls in two different ways. First, we analyzed the impact of the emission controls on the immediate area in which they were applied. We applied the local control measures in three sample cities: Philadelphia, Birmingham, and Chicago. The group of local emissions controls was estimated to achieve ambient annual average $PM_{2.5}$ reductions ranging from about 0.5 µg/m3 to about 0.9 µg/m3, which was less than the amount needed to bring any of the three cities into attainment in 2010. The detailed results of this three-city analysis are provided in section IV. (69 FR 4582 January 30, 2004)*

And EPA goes on to state:

> *These analyses further conclude that sources of SO_2 and NO_X emissions continue to play a strong role in transported $PM_{2.5}$. They suggest that nearly all the particulate sulfate in the cities we examined appears to result from transport from upwind sources outside the local urban area, while upwind and local contributions for the particle nitrate and carbonaceous components of $PM_{2.5}$ are likely to come from both upwind and local sources. These findings are consistent with what is known about the location of emissions sources for these pollutants and their atmospheric formation and transport mechanisms. (69 FR 4582 January 30, 2004)*

Therefore, based on EPA's studies, it is concluded that sulfate components of $PM_{2.5}$ concentrations result from emissions across an entire region of the country including sources well outside the local urban area; whereas, the nitrate and carbonaceous mass components of $PM_{2.5}$ concentrations result from emissions both inside and outside the local urban area. This information is critical in determining the cause of the violation at the Granite City monitor. Speciation data must be analyzed at the Granite City monitor; a monitor that is representative of the St. Louis Region as a whole; and also a monitor that is outside the St. Louis urban core, but in the same region of the country. By comparing speciation data from three such monitors, the data can be used to determine the nature of the $PM_{2.5}$ concentrations in the region, the St. Louis area and the immediate area surrounding the Granite City monitor, which can then aide in determining the sources that are likely responsible for the elevated concentrations being recorded at the Granite City monitor.

Figure 13 compares the averaged SANDWICHED CSN speciation data for the years 2009 – 2010 at Granite City, Blair Street, and the Mingo National Wildlife Refuge in Stoddard County.

Mingo is located approximately 150 miles south of the St. Louis urban core, and the speciation data at this monitor is helpful in determining regional background levels. As seen in Figure 13, sulfate and organic carbon species comprise a majority of the $PM_{2.5}$ concentrations at Blair Street and Granite City (approximately 70% of the total $PM_{2.5}$ concentrations at each site). Sulfates appear to be uniform across all three sites. Nitrates are higher at Blair Street and Granite City than they are in Mingo. Organic carbon species vary significantly among all three sites. Elemental carbon particulates appear to be uniform with all sites averaging less than 1 μg/m^3. Crustal particulates are highest at Granite City and Mingo, but are less than 1 μg/m^3 at Blair Street.

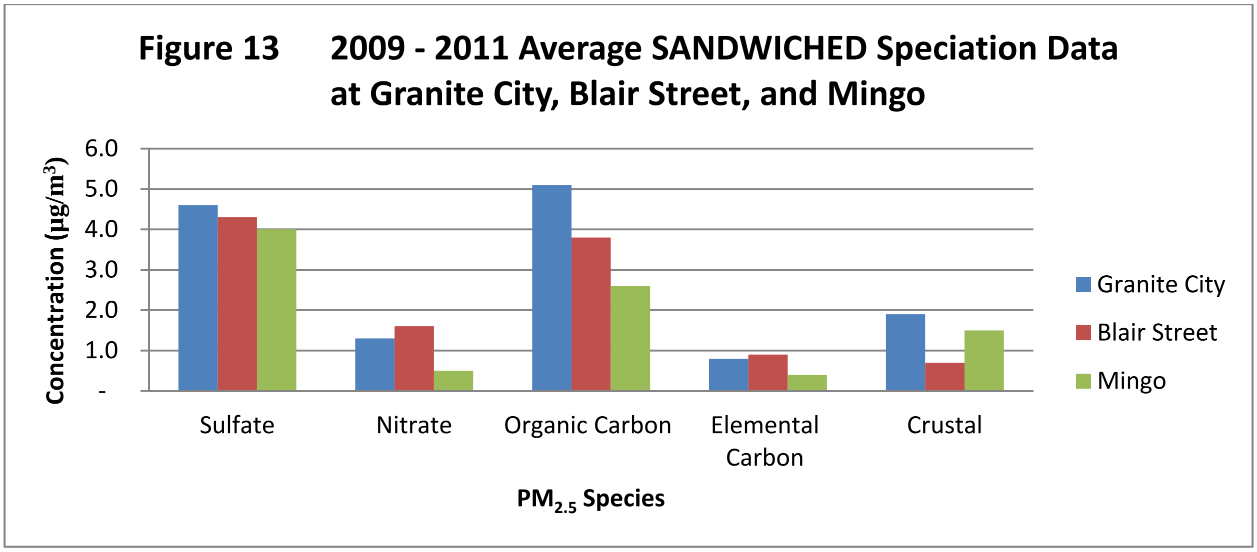


Figure 13 generated with data taken from EPA's 2012 $PM_{2.5}$ Designation Guidance and Tools Webpage: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm

As discussed above, sulfate particulates usually result from emissions across an entire region of the country including sources well outside the local urban area. This conclusion is supported for the St. Louis area through Figure 13. The average sulfate concentrations range from 4.0 μg/m^3 to 4.6 μg/m^3 at each of these three sites over the three years analyzed. Therefore, although SO_X emissions on the Missouri side of the St. Louis MSA comprise 90 percent of the total SO_X emissions in the MO/IL St. Louis MSA, when evaluating the sulfate particulate species upwind and downwind of these sources, the contribution from Missouri sources seems to have a very limited impact on the sulfate $PM_{2.5}$ concentrations experienced in the St. Louis area. However, sulfates do comprise approximately 30% - 40% of the total $PM_{2.5}$ concentrations in the St. Louis area, which will likely need to be addressed in order for the Granite City monitor to attain the 2012 $PM_{2.5}$ NAAQS in the future. Because the background concentrations of sulfate particulates are so uniform across the region both inside and outside the St. Louis urban area, this will likely most effectively be addressed through a federal interstate transport rule that requires SO_X emissions reductions across broad regions of the country to address upwind states' significant contribution to downwind states concerning the 2012 $PM_{2.5}$ NAAQS.

Particulate organic carbon is different from sulfates as it is the result of both regional and local source contributions. As seen in Figure 13, the organic particulate species are higher at Blair Street and Granite City when compared to Mingo, indicating that there is an urban contribution

to this species. However, organic particulates measured at Granite City over the three year period analyzed exceed the levels recorded at Blair Street by more than 1 $\mu g/m^3$. Therefore, while there does appear to be an urban increment for organic particulates, there is also an intra-urban increment for this particulate species that is impacting the Granite City monitor more so than the rest of the St. Louis area. Taking this into consideration in combination with the wind directions and HYSPLIT trajectories on the high and low days, the data indicates that the two sources about 1 mile south of the Granite City Monitor could be causing the organic particulate levels at Granite City to exceed the levels measured in the St. Louis Urban core.

Nitrate and elemental carbon particulates, similarly to organic particulates, are also attributable to both regional and local source contributions. Comparing the nitrate speciation data from the three monitors, shows that nitrate levels are higher at Blair Street and Granite City than they are in Mingo, which indicates there is likely urban component of nitrate levels in St. Louis. However, the nitrate levels at Granite City are lower than the levels at Blair Street, and only 0.8 $\mu g/m^3$ higher than the levels experienced at the background site in Mingo. Therefore, the urban nitrate component, even if completely eliminated, would have a minimal impact on the $PM_{2.5}$ concentrations measured at the violating monitor in Granite City. Elemental carbon particulate levels are lower than 1 $\mu g/m^3$ at all three sites, meaning the urban contribution for this particulate species is relatively insignificant on the $PM_{2.5}$ concentrations measured at Granite City.

Finally, looking at the crustal components, which include metals such as calcium, iron, cadmium, manganese, silicon, and aluminum, Granite City averages over 100% higher levels of crustal particulate than Blair Street. This is a clear indication that an intra-urban crustal particulate component is impacting the Granite City monitor more so than the rest of the St. Louis area. Iron is the predominant crustal species at Granite City. Because iron is the main ingredient in steel production, it is likely that the U.S. Steel facility is responsible for the majority of the crustal particulate component measured at Granite City. Subsection 5.3 analyzes this theory by comparing $PM_{2.5}$ concentrations and particulate speciation data at Granite City during and after the shutdown and reopening of the U.S. Steel facility. The crustal particulate levels at Mingo are also much higher than they are at Blair Street. However, the high crustal particulate levels at Mingo can be explained by examining the predominant crustal species, silicon, which is found in earthen materials such as sands and quartz. Unpaved areas with winds disturbing natural dirt and sands along with agricultural tilling operations can cause high silicon levels.

In addition to the three year annual averaged speciation data at Granite City, the Air Program analyzed daily speciation at Granite City and Blair Street during days in which the $PM_{2.5}$ concentrations were at their highest levels in Granite City from 2010 – 2012. Speciation samplers did not operate on the same schedule as the FRM/FEM monitors located at Granite City and Blair Street. Therefore, not all of the high $PM_{2.5}$ episode days listed in Table 1 could be evaluated. Table 13 lists the SANDWICHED speciation data for each of the high $PM_{2.5}$ episode days where the speciation data was also available. It is noted that this SANDWICHED speciation data was developed using a spreadsheet that was developed by Washington University during the development of the attainment demonstration for the St. Louis area for the 1997 Annual $PM_{2.5}$ NAAQS. The method of converting CSN speciation data into SANDWICHED data is a relatively new concept and has been refined over the last few years. Because the Air Program does not possess the tools to convert CSN data into SANDWICHED data using the latest EPA methods and calculations, this tool was used to develop the SANDWICHED data

presented in Table 13. While the methods of developing the SANDWICHED data listed in Table 13 may not exactly align with EPA's latest methods, it is still useful in analyzing the $PM_{2.5}$ species at both Granite City and Blair Street on these days where Granite City measured some of its highest $PM_{2.5}$ concentrations from 2010 – 2012.

As seen in the table, the predominant $PM_{2.5}$ species on several of the episode days evaluated was organic particulates. However, on two of the days evaluated, the crustal particulate component at Granite City was more than all of the other species calculated for that monitor, and on 1/27/11, nitrate was the predominant component at both monitors. Two of the days analyzed below were also identified as outlier days (3/9/10 and 9/6/12) in Tables 10 – 12, because the total $PM_{2.5}$ concentrations at Granite City were greater than 25% higher than the concentrations recorded at Blair Street (highlighted in yellow in Table 13). Note that on 9/6/12 the organic particulates at Granite City were calculated to be 65.65 µg/m^3. This is an extremely high number, well above the value calculated for Blair Street (+1,100%). As seen in Table 12, the total $PM_{2.5}$ concentrations at Granite City and Blair Street were 24.1 µg/m^3 and 10.1 µg/m^3, respectively. Ignoring this outlier day, the average organic particulates for the days analyzed at Granite City would equal 7.53 µg/m^3, which is comparable to the average organic particulate levels at Blair Street during the days evaluated. Therefore, the only significant difference between the species measured at Granite City and Blair Street on these high episode days is the crustal particulate species. The average crustal particulate levels calculated at Granite City for the episode days evaluated are over 350% higher than the levels calculated for the Blair Street site. This evaluation further supports the fact that direct emissions of crustal particulates comprise the majority of the increment between these two sites and are likely causing the difference in the design values at these two sites, and in turn, the violation at the Granite City Monitor.

Table 13. Daily SANDWICHED Speciation Data at Granite City and Blair Street During High $PM_{2.5}$ Episode Days at Granite City (all values rounded to nearest 0.01 µg/m^3)

Date	Granite City Sulfate	Blair Sulfate	Granite City Nitrate	Blair Nitrate	Granite City Organic Matter	Blair Organic Matter	Granite City Elemental Carbon	Blair Elemental Carbon	Granite City Crustal	Blair Crustal
3/9/2010	5.78	5.3	3.84	3.98	9.11	7.43	0.76	0.94	2.34	0.42
12/10/2010	3.21	3.23	4.52	4.65	5.42	7.82	1.43	2.38	9.24	0.71
12/28/2010	2.85	3.23	4.31	4.33	4.29	7.68	1.05	1.47	6.74	0.73
1/27/2011	3.21	3.15	9.25	9.53	1.11	1.17	1.44	1.17	1.71	0.5
8/1/2011	7.51	7.28	0	0	5.7	8.65	0.98	1.25	1.96	0.67
1/10/2012	1.21	1.05	3.59	3.5	11.18	10.99	0	2.81	1.79	1.78
7/2/2012	3.15	4.68	0	0	15.87	10.2	0	1.36	4.37	1.94
9/6/2012	0.04	2.46	0	0	65.65	5.59	0	1.14	0.02	1.11
Average For Days Analyzed	**3.37**	**3.80**	**3.19**	**3.25**	**14.79**	**7.44**	**0.71**	**1.57**	**3.52**	**0.98**

5.3 Analysis of $PM_{2.5}$ Concentrations and Speciation Data During and After the U.S. Steel Facility Shutdown and Reopening

In December of 2008, U.S. Steel shutdown much of the operations at their steel mill located in Granite City, Illinois, but in late 2009 the mill restarted operations. The quarterly average $PM_{2.5}$ concentrations at this monitor were evaluated before, during, and after this 1- year period to determine the impact that this source had on ambient $PM_{2.5}$ concentrations at the Granite City monitor. Table 14 lists the quarterly average $PM_{2.5}$ concentrations at the Granite City site along with the annual averages from 2007 – 2010 (values listed in red are during the period of the facility shutdown), and Figure 14 displays these values graphically. As can be seen, in 2009 the Granite City monitor had an annual average $PM_{2.5}$ concentration of 11.3 $\mu g/m^3$, which is typical of $PM_{2.5}$ concentrations in the St. Louis area and below the level of the 2012 $PM_{2.5}$ NAAQS. However, during the years before and after the shutdown, the average annual concentrations were over 14 $\mu g/m^3$, which is well above the level of the 2012 $PM_{2.5}$ NAAQS. Through this simple analysis, it is clear that this source has a significant impact on the ambient $PM_{2.5}$ concentrations at this location, and is most likely causing the violation of the standard. With a regional annual average $PM_{2.5}$ concentration over the same period in the St. Louis, Missouri area ranging from approximately 10.0 $\mu g/m^3$ – 12.0 $\mu g/m^3$ (Figure 2 in Subsection 2.2), it is clear that without the influence of this local source in Granite City the entire region on both sides of the MSA would be in compliance with the 2012 $PM_{2.5}$ NAAQS.

In addition to gauging the level of the design values at the Granite City monitor, the speciation data at Granite City and Blair Street in 2009 is compared with the speciation data in 2010 and 2011. Figures 15 – 17 display the speciation data at these two monitors for 2009 – 2011, respectively. The species of sulfate, nitrate, and elemental carbon are relatively unchanged at both monitors from 2009 – 2011. However, similar to the design value evaluation above, while the U.S. Steel plant was shut down during 2009, all species of the $PM_{2.5}$ were very similar at both Blair Street and Granite City, but in 2010 and 2011, after the plant re-opened, organic carbon and crustal emissions at Granite City far exceed the levels at Blair Street. This aligns with the meteorology, emissions data and source location, and the general speciation data analysis at these two sites. All of these facts further support the conclusion that although there is an urban contribution from much of the MSA on both sides of the river to the Region as a whole, this individual source is causing the excess levels of organic and crustal particulate measured at the Granite City monitor that is causing the violation of the 2012 $PM_{2.5}$ NAAQS.

Table 14 Quarterly and Annual Average concentrations at the Granite City Monitor (2007 – 2010)																				
	2007					**2008**					**2009**					**2010**				
	Qtr-1	**Qtr-2**	**Qtr-3**	**Qtr-4**	**2007 Annual Avg.**	**Qtr-1**	**Qtr-2**	**Qtr-3**	**Qtr-4**	**2008 Annual Avg.**	**Qtr-1**	**Qtr-2**	**Qtr-3**	**Qtr-4**	**2009 Annual Avg.**	**Qtr-1**	**Qtr-2**	**Qtr-3**	**Qtr-4**	**2010 Annual Avg.**
Average $PM_{2.5}$ Concentration ($\mu g/m^3$)	**14.3**	**15.3**	**17.6**	**13.2**	**15.1**	**15.6**	**15.7**	**18.7**	**11.9**	**15.7**	**12.7**	**10.4**	**11.7**	**10.5**	**11.3**	**14.2**	**13.8**	**14.4**	**14.7**	**14.3**

Figure 14 Average Quarterly $PM_{2.5}$ Concentrations at the Granite City Monitor (2007 - 2010)

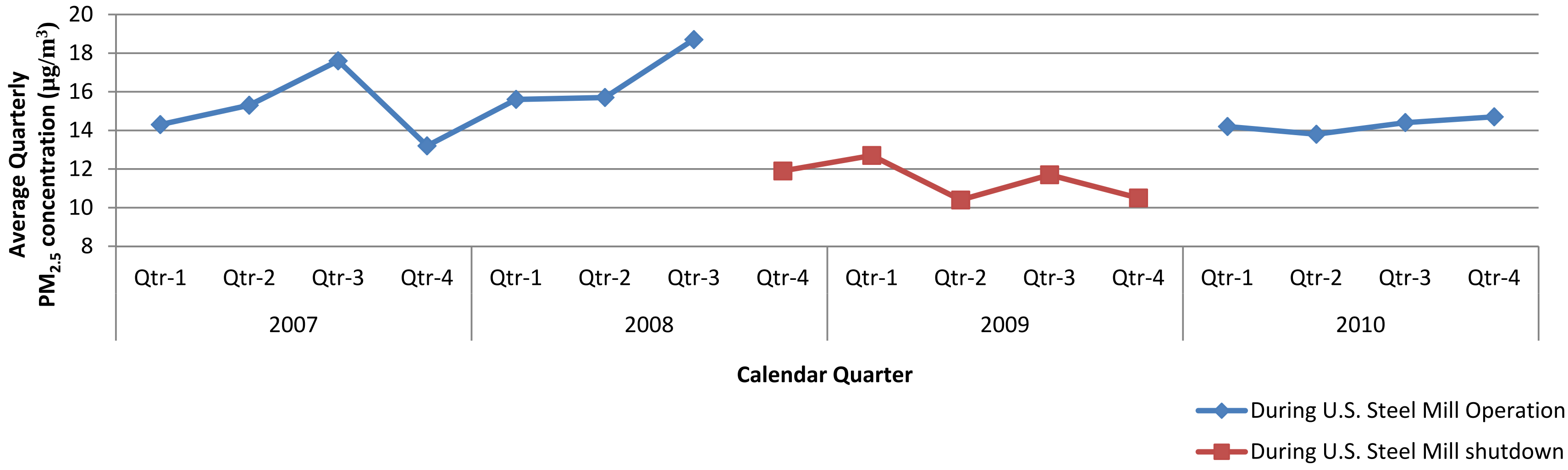


Figure 15 2009 Average SANDWICH Speciation Data from CSN Monitors at Granite City and Blair Street

(During the Shutdown of U.S. Steel Facility)

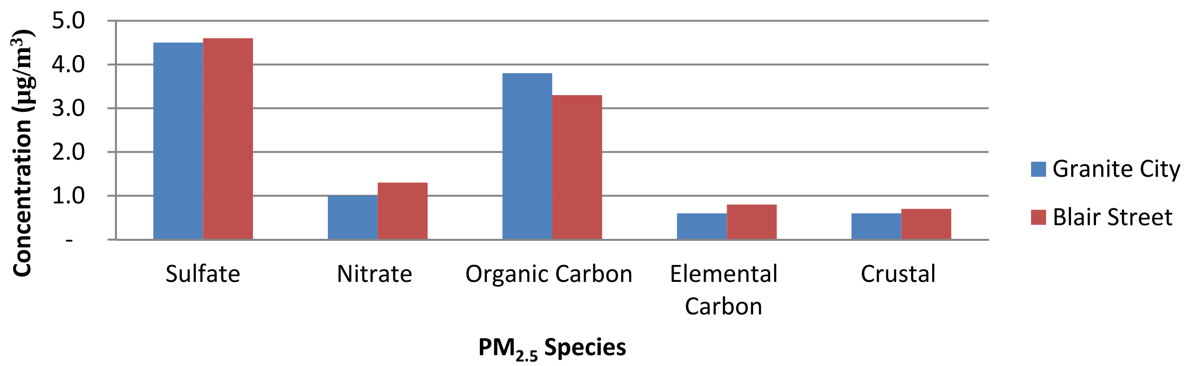


Figure 16 2010 Average SANDWICH Speciation Data from CSN Monitors at Granite City and Blair Street

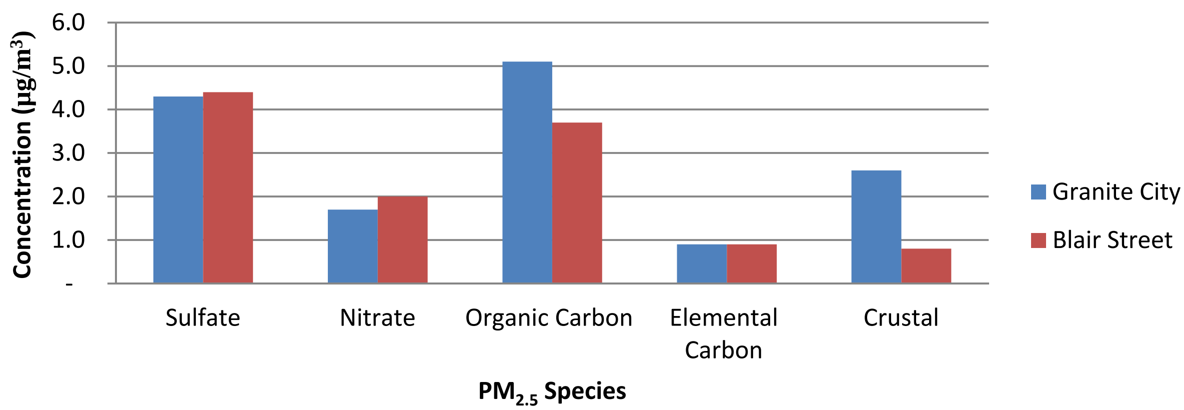
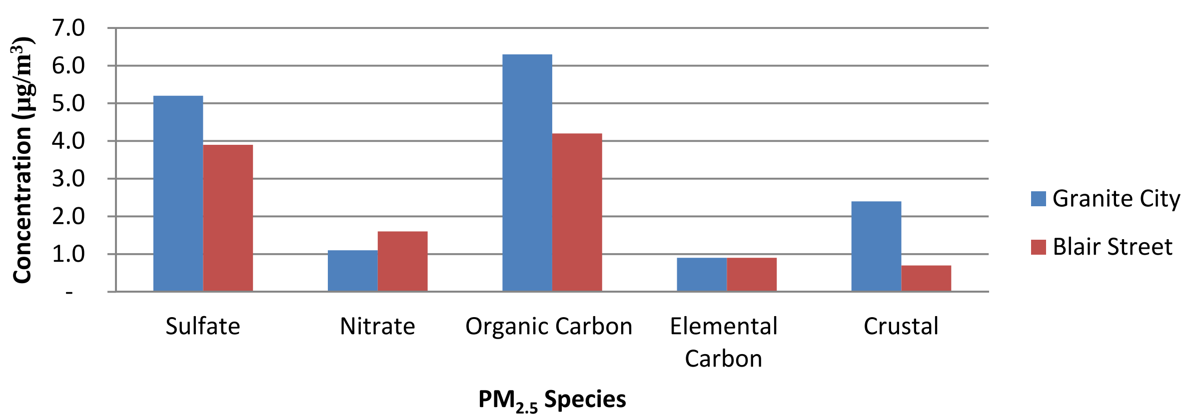


Figure 17 2011 Average SANDWICH Speciation Data from CSN Monitors at Granite City and Blair Street



Figures 15 - 17 generated with data taken from EPA's 2012 $PM_{2.5}$ Designation Guidance and Tools Webpage: http://www.epa.gov/pmdesignations/2012standards/techinfo.htm

5.4 Annual $PM_{2.5}$ Concentrations in Granite City vs. U.S. Steel Emissions

Subsection 5.3 analyzes the $PM_{2.5}$ concentrations in Granite City in the time period surrounding the shutdown of the U.S. Steel facility. It is also important to note that some control strategies have been implemented at the U.S. Steel facility since 2002, resulting in a reduction of direct $PM_{2.5}$ and $PM_{2.5}$ precursor emissions from the facility. To more fully understand how emissions from this facility are impacting $PM_{2.5}$ concentrations, $PM_{2.5}$ and $PM_{2.5}$ precursor emissions from this facility must be compared to the annual average $PM_{2.5}$ concentrations recorded by the Granite City monitor over a longer period of time. Table 15 lists the $PM_{2.5}$ and $PM_{2.5}$ precursor emissions from the U.S. Steel facility in Granite City for the years 2002, 2005, 2008, and 2011. Figure 18 displays the annual average $PM_{2.5}$ concentrations recorded by the Granite City monitor from 2000 – 2012. As seen in Table 15, $PM_{2.5}$ and $PM_{2.5}$ precursor emissions from the facility have decreased from 2002 to 2011. These emissions reductions combined with other regional emissions reductions have resulted in a reduction in $PM_{2.5}$ concentrations recorded by the Granite City monitor from 17.4 μg/m^3 in 2000 down to 12.8 μg/m^3 in 2012.

Although some controls have been implemented at the U.S. Steel facility resulting in reductions in direct $PM_{2.5}$ emissions, in 2011, the source still emitted approximately 748 tons of direct $PM_{2.5}$ emissions and approximately 2,912 tons of $PM_{2.5}$ precursor emissions. This information combined with the analysis of the shutdown of the facility in subsection 5.3 shows that emissions at the U.S. Steel facility have a direct impact on the $PM_{2.5}$ concentrations in the area. The correlation of emissions from this source with the annual $PM_{2.5}$ concentrations in Granite City further supports the conclusion that this source is causing the violation at the Granite City monitor.

Table 15 Emissions from the U.S. Steel Facility in Granite City, IL

	2002	2005	2008	2011
Direct $PM_{2.5}$ Emissions (tons/year)	1,489.12	518.76	526.38	747.65
SO_2 Emissions (tons/year)	4,652.45	6,396.65	5,598.62	1,430.34
NO_X Emissions (tons/year)	3,464.14	3,735.56	3,420.02	1,188.86
VOC Emissions (tons/year)	230.79	240.937	221.79	293.06
NH_3 Emissions (tons/year)	8.70	32.7972	10.82	9.07

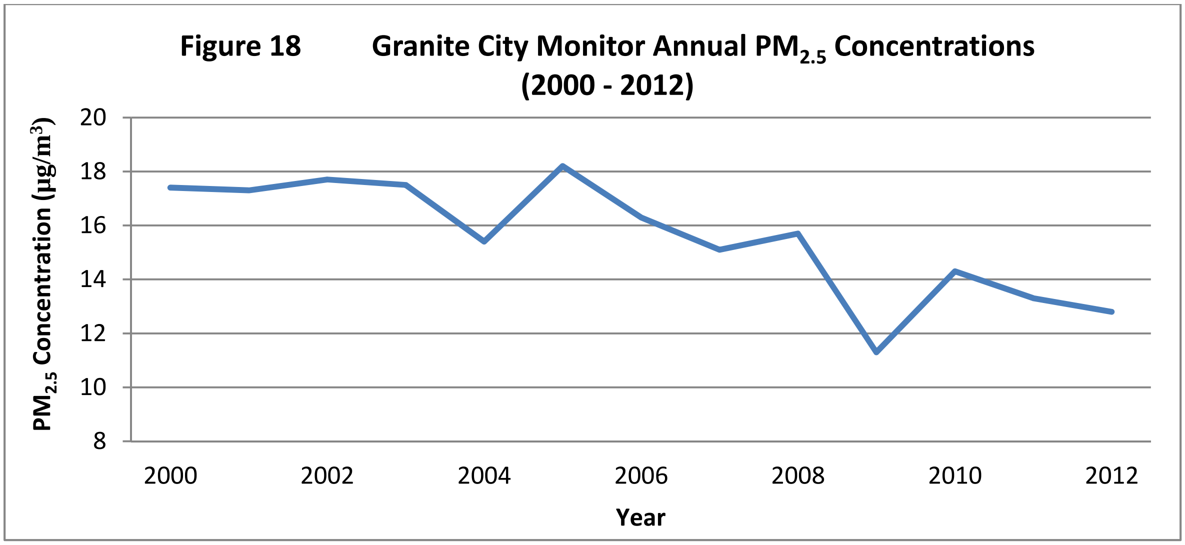


Figure 18 Granite City Monitor Annual PM2.5 Concentrations
(2000 - 2012)
PM2.5 Concentration (µg/m3)
20
18
16
14
12
10
8
2000
2002
2004
2006
2008
2010
2012
Year

6. Consideration of Potential Control Strategies for Missouri Sources in the St. Louis Area

It is important to note that the St. Louis area is currently designated nonattainment for the 1997 $PM_{2.5}$ NAAQS. The nonattainment area includes the City of St. Louis and the Counties of Jefferson, St. Louis, St. Charles, and Franklin on the Missouri side, as well as the Township of Baldwin and the Counties of Monroe, St. Clair, and Madison on the Illinois side. The area has obtained clean data based on 2007 – 2009 monitoring data, and Missouri has submitted a maintenance plan and redesignation request for the Missouri side of the nonattainment area to be redesignated to attainment under the 1997 standard. A large bi-state effort between Missouri and Illinois to install controls to reduce emissions of direct $PM_{2.5}$ and $PM_{2.5}$ precursors was performed to meet the Clean Air Act requirements that were triggered when the area was designated nonattainment for the 1997 $PM_{2.5}$ NAAQS. Additionally, many large sources of $PM_{2.5}$ precursor emissions (NO_X and SO_X) have traditionally been controlled through regional emissions programs aimed at reducing background $PM_{2.5}$ concentrations and long-range transport of these emissions, which has also played an important role in reducing annual average $PM_{2.5}$ concentrations across the St. Louis area. Finally, there are numerous federal rules coming into place that will help control $PM_{2.5}$ and $PM_{2.5}$ precursor emissions from some of the largest source categories. This section analyzes the local control measures developed for the 1997 $PM_{2.5}$ NAAQS, the various federal control measures currently being phased in, and the expectation of interstate transport requirements. All of these measures have been compared to Missouri's sources to determine if other additional control measures would be feasible that could produce tangible benefits in terms of $PM_{2.5}$ concentrations in the St. Louis area.

Area sources are difficult to control, and there is uncertainty in the inventory which is largely based on generic emissions calculations. Mobile sources, both on-road and non-road, continue to decline based on federal motor vehicle and non-road engine standards, and this trend is only expected to continue not only in St. Louis but across the country. Furthermore, most states, including Missouri, do not control mobile source emissions through state-specific motor vehicle and non-road engine standards. Most states rely upon federal regulations to control these emissions. Therefore, the only source category that states can typically control through regulations and state implementation plans are permitted point sources. For this reason, much of the analysis in this section compares individual source emissions to total point source emissions in the MO/IL St. Louis MSA.

6.1 Electric Generating Units on the Missouri-Side of the St. Louis Area

Table 16 displays the direct $PM_{2.5}$ and $PM_{2.5}$ precursor emissions in 2011 for the four major electric generating units located on the Missouri side of the St. Louis MSA. These four units are all owned by Ameren and make up a substantial portion of the MSA's point source emissions of direct $PM_{2.5}$, NO_X, and SO_X. Each of these facilities is currently subject to the EPA's Clean Air Interstate Rule (CAIR), which is a regional emission trading program aimed at reducing the $PM_{2.5}$ precursor emissions of NO_X, and SO_2 from electric generating units in the eastern half of the country. It is noted that CAIR has been remanded to EPA; however the courts have directed EPA to continue implementing CAIR until a suitable replacement rule is promulgated. In 2015,

if CAIR has not been replaced, CAIR phase II will begin, which will require further reductions of NO_X and SO_2 emissions from electric generating units that are subject to the rule.

In addition to CAIR, or its expected replacement, the EPA promulgated the Mercury and Air Toxics Standards (Utility MATS) for electric generating units in 2011. Utilities have up to three years to comply with the requirements of this rule with an option for a fourth year if the additional year is necessary for the installation of controls. The Utility MATS requires emissions reductions in mercury and acid gases. It also requires reductions in other hazardous air pollutants, which are measured using $PM_{2.5}$ as a surrogate. Therefore, direct $PM_{2.5}$ emissions are expected to be controlled directly through the Utility MATS rule. Furthermore, while NO_X and SO_2 may not be controlled directly through Utility MATS at EGUs, some control strategies for controlling emissions of acid gases, mercury, and direct $PM_{2.5}$ are expected to have co-benefits for reducing SO_2 and NO_X emissions. It is noted that as part of Ameren's long range planning for environmental compliance, they installed flue-gas desulfurization on their two stacks in their Sioux plant located in St. Charles County in late 2010. This resulted in the reduction of nearly 40,000 tons/year of SO2 emissions, and further demonstrates that these federal rules are resulting in actual significant emissions reductions not only in St. Louis but across the entire country, which is helping to lower the background $PM_{2.5}$ concentrations across the U.S. and in turn the $PM_{2.5}$ concentrations in urbanized areas, such as St. Louis.

Table 16 2011 Missouri EGU Emissions and Percentages in the St. Louis MSA

Facility Name	NH_3	NO_X	PM_{25}-PRI	SO_2	VOC
AMEREN MISSOURI-LABADIE PLANT EMISSIONS (TONS/YEAR)	3.04	9,891.46	1,712.14	57,948.81	323.15
Labadie Percent of Total MSA Point Source Emissions	0.25%	24.65%	38.14%	41.70%	4.35%
Labadie Percent of Total MSA Emissions	0.02%	7.68%	4.97%	41.31%	0.40%
AMEREN MISSOURI-RUSH ISLAND PLANT EMISSIONS (TONS/YEAR)	1.40	3,441.72	246.31	28,035.57	149.11
Rush Island Percent of Total MSA Point Source Emissions	0.11%	8.58%	5.49%	20.17%	2.01%
Rush Island Percent of Total MSA Emissions	0.01%	2.67%	0.72%	19.98%	0.19%
AMEREN MISSOURI-SIOUX PLANT EMISSIONS (TONS/YEAR)	0.80	7,073.99	413.53	4,899.10	156.51
Sioux Percent of Total MSA Point Source Emissions	0.07%	17.63%	9.21%	3.53%	2.11%
Sioux Percent of Total MSA Emissions	0.01%	5.50%	1.20%	3.49%	0.19%
AMEREN MISSOURI-MERAMEC PLANT EMISSIONS (TONS/YEAR)	1.13	4,789.24	171.93	15,281.50	105.65
Meramec Percent of Total MSA Point Source Emissions	0.09%	11.93%	3.83%	11.00%	1.42%
Meramec Percent of Total MSA Emissions	0.01%	3.72%	0.50%	10.89%	0.13%
Combined Missouri EGU Percent of Total MSA Point Source Emissions	0.52%	62.78%	56.67%	76.40%	9.90%
Combined Missouri EGU Percent of Total MSA Emissions	0.05%	19.58%	7.39%	75.67%	0.91%

As seen in Table 16, these four EGUs, which will be controlled through the Utility MATS and either CAIR or its replacement, comprised 62.8%, 56.7%, and 76.4% of total point source NO_X, direct $PM_{2.5}$, and SO_2 emissions respectively for the entire IL/MO St. Louis MSA in 2011. Because these four sources will be controlled through these two federal rules, it is unlikely that controls beyond what will be required by these two rules would be feasible/necessary even if these sources are included in the nonattainment area that will result from the violating Granite City Monitor.

6.2 Maximum Achievable Control Technology for Industrial/Commercial/Institutional Boilers (Boiler MACT)

On March 21, 2011, EPA promulgated maximum achievable control technology requirements for industrial/commercial/institutional boilers (Boiler MACT) (76 FR 1541). However, implementation of this rule was delayed while EPA reconsidered certain aspects of the rule. The revised rule was released on January 31, 2013 (78 FR 7138). This rule requires existing industrial/commercial/institutional boilers that meet major source threshold requirements to reduce their emissions of acid gases, mercury, dioxin/furans, organic hazardous air pollutants (HAPs), and non-mercury metallic HAPs. While, this rule is intended to control emissions of air toxics, compliance for the limits on the non-mercury metallic HAPs will be determined using filterable $PM_{2.5}$ emissions as the surrogate. Therefore, direct $PM_{2.5}$ emissions will be controlled through this regulation for existing sources subject to the rule. Additionally, the control requirements for acid gases, mercury, dioxin/furans, and organic HAPs will likely have co-benefits for NO_X, SO_X, and VOC emissions for existing sources subject to the rule.

The Air Program has performed preliminary research to determine the existing facilities with boilers that will be subject to this rule. The facilities that are located in the Missouri portion of the St. Louis MSA as well as the facilities located in Missouri counties bordering the St. Louis MSA have been listed below in Table 17. As seen in the table, 23 facilities located in or surrounding the Missouri portion of the St. Louis MSA have a total of 115 emissions units that will be subject to the Boiler MACT, and will be required to comply with the rule beginning January 31, 2016. This is expected to result in further point source emissions reductions of direct $PM_{2.5}$ and $PM_{2.5}$ precursors. In addition, the Boiler MACT established limits for new sources that are more stringent than the requirements for existing sources, ensuring that any industrial/commercial/institutional boilers that are constructed in the future will be well controlled under this federal rule.

Table 17 Missouri Facilities in and Around the St. Louis MSA with Units Subject to the Boiler MACT			
County	**Plant ID**	**Facility Name**	**Number of Boilers Subject to Boiler MACT**
Franklin	0014	CANAM STEEL CORP	1
Franklin	0132	SPORLAN VALVE DIVSION	1
Jefferson	0002	RIVER CEMENT CO. DBA BUZZI UNICEM USA	1
Jefferson	0003	DOE RUN COMPANY	4
Jefferson	0016	Ameren Missouri	4
St. Charles	0001	Ameren Missouri	2
St. Charles	0010	BOEING COMPANY	3
St. Charles	0076	GENERAL MOTORS LLC	9
Ste. Genevieve	0001	MISSISSIPPI LIME COMPANY	13
Ste. Genevieve	0035	CHEMICAL LIME COMPANY	4
St. Louis	0226	GREIF-FENTON	3
St. Louis	0230	BOEING COMPANY	16
St. Louis	0231	CHRYSLER GROUP LLC NORTH PLANT	3
St. Louis	1012	BELT SERVICE CORP	2
St. Louis	1489	GKN AEROSPACE NORTH AMERICA, INC.	3
St. Louis City	0003	ANHEUSER-BUSCH INC	4
St. Louis City	0017	MALLINCKRODT INC	9
St. Louis City	0027	PRECOAT METALS	9
St. Louis City	0040	WASHINGTON UNIV MEDICAL SCHOOL	10
St. Louis City	0697	SIGMA - ALDRICH MFG LLC	7
St. Louis City	1123	U. S. RINGBINDER CORP	2
St. Louis City	1460	ALLIED HEALTH CARE PRODUCTS	1
St. Louis City	2433	NEW WORLD PASTA	4

6.3 Implementation of Reasonably Available Control Technology (RACT) for Missouri Sources Under the 1997 $PM_{2.5}$ NAAQS

As mentioned above, the City of St. Louis and the Counties of St. Louis, St. Charles, Franklin, and Jefferson were included in the MO/IL St. Louis nonattainment areas under the 1997 Annual $PM_{2.5}$ NAAQS. As required by the Clean Air Act and the Implementation Rule for this standard, RACT evaluations were performed for all significant point sources located in the nonattainment area. Implementation of RACT under the 1997 $PM_{2.5}$ NAAQS in the St. Louis area required RACT analyses for all sources on the Missouri side that had direct $PM_{2.5}$ emissions above 10 tons/year and were within 10 miles of the Granite City monitor, as this was the design value monitor for the area. The 10 mile radius for sources of direct $PM_{2.5}$ emissions was selected for the RACT evaluation because direct $PM_{2.5}$ emissions have a very localized impact on $PM_{2.5}$ concentrations and do not have a significant impact on $PM_{2.5}$ concentrations in areas at greater distances downwind. The RACT implementation also included RACT analyses for all point sources with NO_X emissions greater than 50 tons/year and all point sources with SO_2 emissions greater than 25 tons/year.

Through the RACT evaluation several sources in the nonattainment area implemented control strategies that were determined to be RACT. Several sources also demonstrated that the control technologies already in place satisfied RACT because additional controls were either too costly or not feasible. Table 18 provides a list of the sources in St. Louis that were required to perform RACT evaluations under the 1997 $PM_{2.5}$ NAAQS for each of these three pollutants.

Table 18 2011 Missouri Sources Required to Perform a RACT Evaluation Under the 1997 $PM_{2.5}$ NAAQS

Direct $PM_{2.5}$ Sources		
County	**2008 Facility ID**	**Facility Name**
St. Louis City	510-0156	AMERICAN COMMERCIAL TERMINALS
St. Louis City	510-0040	WASHINGTON UNIVERSITY MEDICAL SCHOOL
St. Louis City	510-0809	PQ CORPORATION
St. Louis City	510-0003	ANHEUSER BUSCH - ST. LOUIS
St. Louis City	510-0072	FEDERAL MOGUL FRICTION PRODUCTION
St. Louis City	510-0053	ST. LOUIS METROPOLITAN SEWER DISTRICT - BISSEL
St. Louis City	510-0057	PROCTOR & GAMBLE
St. Louis City	510-2565	BEELMAN RIVER TERMINALS
St. Louis City	510-0017	MALLINCKRODT INC
NO_X Sources		
County	**2008 Facility ID**	**Facility Name**
Franklin	071-0003	AMERENUE - LABADIE
Jefferson	099-0002	RC CEMENT COMPANY (BUZZI UNICEM)
Jefferson	099-0016	AMERENUE - RUSH ISLAND
Jefferson	099-0068	SAINT - GOBAIN CONTAINERS - PEVELY
St. Charles	183-0001	AMERENUE - SIOUX
St. Charles	183-0076	GENERAL MOTORS - WENTZVILLE
St. Charles	183-0027	MEMC ELECTRONIC MATERIALS
St. Louis City	510-0003	ANHEUSER-BUSCH INC - ST. LOUIS
St. Louis City	510-2378	LACLEDE GAS
St. Louis City	510-0809	PQ CORPORATION
St. Louis City	510-0038	TRIGEN - ASHLEY STREET
St. Louis City	510-0017	MALLINCKRODT INC
St. Louis City	510-0053	ST. LOUIS METROPOLITAN SEWER DISTRICT - BISSEL
St. Louis County	189-0010	AMERENUE - MERAMEC
St. Louis County	189-0230	BOEING COMPANY
St. Louis County	189-0231	CHRYSLER CORP-NORTH PLANT
St. Louis County	189-1205	ST. LOUIS METROPOLITAN SEWER DISTRICT - MO RIVER
St. Louis County	189-1210	ST. LOUIS METROPOLITAN SEWER DISTRICT - COLDWATER
St. Louis County	189-0217	ST. LOUIS METROPOLITAN SEWER DISTRICT - LEMAY
SO_2 Sources		
County	**2008 Facility ID**	**Facility Name**
Franklin	071-0003	AMERENUE - LABADIE
Jefferson	099-0003	DOE RUN COMPANY - HERCULANEUM
Jefferson	099-0016	AMERENUE - RUSH ISLAND
Jefferson	099-0002	RC CEMENT COMPANY (BUZZI UNICEM)
Jefferson	099-0068	SAINT - GOBAIN CONTAINERS - PEVELY
St. Charles	183-0001	AMERENUE - SIOUX
St. Charles	183-0076	GENERAL MOTORS - WENTZVILLE
St. Louis City	510-0003	ANHEUSER-BUSCH INC - ST. LOUIS
St. Louis City	510-0017	MALLINCKRODT INC
St. Louis City	510-0809	PQ CORPORATION
St. Louis City	510-0038	TRIGEN - ASHLEY STREET
St. Louis City	510-0040	WASHINGTON UNIVERSITY MEDICAL SCHOOL
St. Louis City	510-0053	ST. LOUIS METROPOLITAN SEWER DISTRICT - BISSEL
St. Louis County	189-0010	AMERENUE - MERAMEC
St. Louis County	189-0230	BOEING COMPANY

Through the RACT evaluation performed in 2007 - 2009 for the direct $PM_{2.5}$ sources, no additional controls were required. Many of the sources included in the evaluation were already well controlled at levels of 50% control or greater for their $PM_{2.5}$ emissions. Additionally, due to the relatively low direct $PM_{2.5}$ emissions for the sources evaluated in Missouri and the fact that monitored concentrations on the Missouri side were not experiencing elevated levels like the Granite City monitor, which had two sources less than a mile away emitting over 1,500 tons/year of direct $PM_{2.5}$, it was determined that additional direct $PM_{2.5}$ controls at these facilities would not have a significant impact on the monitored $PM_{2.5}$ concentrations at Granite City.

Through the RACT evaluation performed in 2007 - 2009 for the NO_X sources, Washington University switched their coal fired boilers to natural gas. The Boeing company removed their two coal fired boilers. MEMC signed a consent agreement to continue operating their scrubbers to control NO_X from their acid bath/etching process. This consent agreement has since been terminated due to the retirement of the units for which the agreement applied. St. Gobain Containers installed oxy-fuel firing on both of their glass melting furnaces, and Buzzi Unicem (RC Cement) replaced their long wet kilns with a preheater/precalciner configuration, which lowered their permitted NO_X emissions by over 1,600 tons/year.

The non-utility boilers at General Motors, Trigen – Ashley Street Station, and Mallinckrodt had previously undergone a RACT evaluation under the 1997 Ozone NAAQS and are subject to 10 CSR 10-5.510 *Control of Emissions of Nitrogen Oxides*, which was determined to meet RACT requirements for the 1997 $PM_{2.5}$ NAAQS. The four Ameren facilities were determined to meet RACT after an evaluation of the existing controls and NO_X rates at these facilities combined with their requirements under CAIR. All other facilities were able to demonstrate that additional controls would exceed the requirements of RACT due to economic or logistical feasibility reasons.

Through the RACT evaluation performed in 2007 - 2009 for the SO_2 sources, the first group evaluated was non-boiler sources including PQ Corporation, St. Gobain Containers, Buzzi Unicem (RC Cement), the St. Louis Metropolitan Sewer District, and Doe Run – Herculaneum. The following three sources were not required to install additional SO_2 controls as a result of RACT due to high costs of control and their already relatively low SO_2 emissions: PQ Corporation, St. Gobain Containers, and the Metropolitan Sewer district. Buzzi Unicem (RC Cement) was determined to meet RACT requirements through the replacement of their long wet kilns with a state of the art preheater/precalciner configuration as mentioned above, which effectively reduced SO_2 emissions by 95% through the inherent scrubbing of the new system. Doe Run – Herculaneum was required to reduce SO_2 emissions through a tiered approach as required in 10 CSR 10-6.260 *Restriction of Emission of Sulfur Compounds*, in which SO_2 emissions are limited to 25,100 tons/year in 2012, 16,350 tons/year in 2014, and zero (0) tons/year in 2017. A more recent federal consent decree requires this facility to cease operations at their blast furnace and sinter plant by 2014, eliminating the SO_2 emissions from these units three years sooner than the state rule requires.

The second group evaluated for SO_2 controls through this RACT evaluation was the industrial/commercial/institutional boiler sources including Washington University, Boeing Company, Trigen-Ashley Street Station, Anheuser Busch, Mallinckrodt, and General Motors –

Wentzville. As noted above, Washington University switched their coal fired units to natural gas, and Boeing removed their two coal-fired units. Both of these control strategies were determined to meet RACT requirements. For the other companies, the RACT evaluations were performed and SO_X limits were established based on limits achievable through reasonable controls for each of the boilers and these limits were codified into 10 CSR 10-6.260 *Restriction of Emission of Sulfur Compounds*. Since the RACT evaluation, Trigen-Ashley Street station has retired their coal fired boiler units 5 and 6, and Anheuser Busch has retired its coal fired boiler unit 6.

The last group evaluated for SO_2 controls through this RACT evaluation included the four Ameren EGU facilities, which were determined to meet RACT requirements for SO_2 because of their participation in CAIR. The emissions and expected control measures for these four EGU facilities are discussed in greater detail in the subsection above.

These RACT evaluations for NO_X and SO_2 included an evaluation of the point sources in the St. Louis nonattainment area, accounting for 98% of all point source emissions for these pollutants in the area. The RACT evaluation and corresponding control requirements reduced sulfur dioxide (SO_2) and nitrogen oxides (NOx) emissions from Missouri sources by 20,133 tons/year and 1,067 tons/year, respectively after 2011. However, despite these significant reductions in Missouri's emissions inventory, the photochemical model used in Missouri's attainment demonstration for the 1997 Annual $PM_{2.5}$ NAAQS showed through a sensitivity analysis that these reductions would only decrease the annual $PM_{2.5}$ design value at Granite City by 0.13 $\mu g/m^3$ in 2012, which further supports the conclusion that emissions from Missouri sources do not have a significant impact on the $PM_{2.5}$ concentrations recorded at the Granite City monitor.

This RACT evaluation was submitted to EPA in September 2009 as part of the attainment demonstration for the 1997 $PM_{2.5}$ NAAQS, and because the RACT evaluations were performed so recently, it is unlikely that another RACT evaluation would result in any new control requirements for Missouri sources in the area. Furthermore, as a result of federal control measures discussed above, the required shutdown at the Doe Run facility, and the continued decline of mobile source emissions, it's unlikely that further state or local controls would even be necessary to meet reasonable further progress obligations if Missouri is included in the nonattainment area that will result from the violating monitor in Granite City. Therefore, if areas in Missouri are ultimately included in the nonattainment area that will result from the violating Granite City monitor, few if any new controls in Missouri, beyond what is already in place or expected in the near future, will actually be required for the area. This means there would be no net air quality benefit by designating areas in Missouri nonattainment based on the violating monitor in Granite City, it would only require Missouri to develop a resource intensive attainment demonstration for the area.

7. Jurisdictional Boundaries

It is also important to note that jurisdictional boundaries limit Missouri's ability to require emissions controls that will result in positive impacts to the monitored $PM_{2.5}$ concentrations at the Granite City monitor. The two sources located to the south of the monitor that are believed to be causing the violation at this monitor are located in Illinois, and Missouri has no authority to regulate the emissions from these facilities. Additionally, SO_X emissions from coal fired power plants located outside of both Illinois and Missouri are believed to be contributing to the regional sulfate concentrations that comprise a significant portion of the total $PM_{2.5}$ concentrations in the St. Louis area. Neither Missouri nor Illinois has the authority to control these upwind state emissions; however, these emissions are anticipated to be controlled in the future through a federal interstate transport rule that will address upwind states' significant contribution to nonattainment areas in downwind states under the 2012 $PM_{2.5}$ NAAQS.

Under the 1997 $PM_{2.5}$ NAAQS, Missouri was included in the bi-state MO/IL St. Louis nonattainment area. Much of the attainment related planning efforts including the attainment demonstration, and reasonably availably control technology evaluations focused on the impacts that sources have on the Granite City monitor. With the two Illinois sources less than one mile south of the Granite City monitor, there was little Missouri could do to lower $PM_{2.5}$ concentrations in Granite City. If areas in Missouri are designated nonattainment based on the violating monitor in Granite City under the 2012 $PM_{2.5}$ NAAQS, Missouri will be placed into this situation again where emissions reductions might be needed at these two sources to attain the NAAQS, but Missouri would have no authority to require the necessary controls at these facilities. If this occurs, then Missouri would be required to face the consequences for failing to attain the NAAQS through no fault of our own, which could require even more stringent measures to be adopted in Missouri that may not be cost effective, and still wouldn't have a significant impact on the violating monitor that would drive the design value for the area.

8. Other Considerations

As stated in Section 3 of this Appendix, aggregate emissions in the MSA alone are not enough to determine the relative contribution of these emission sources to a particular $PM_{2.5}$ monitor violation. Sophisticated tools such as dispersion/photochemical modeling and source apportionment analysis are needed to link emissions from particular sources/locations to $PM_{2.5}$ mass measured at monitors due to the complex, nonlinear atmospheric processes and chemistry involved. These types of analyses are time- and resource-intensive and could not be completed for the purpose of this designation process within the established timeline. However, in 2009 – 2010, EPA performed photochemical modeling for a 2012 base case scenario in support of the Federal Cross-State Air Pollution Rule (CSAPR), which provides some insight into impacts from Missouri sources on the Granite City monitor. Through this effort, source apportionment modeling was performed for Missouri sources to determine their contribution to downwind ambient $PM_{2.5}$ concentrations. Because the CSAPR focused on reductions to NO_X and SO_2, these are the two pollutants for which source apportionment modeling results have been displayed on EPA's website (http://www.epa.gov/crossstaterule/techinfo.html).

The source apportionment modeling results (http://www.epa.gov/crossstaterule/pdfs/CSAPR_Ozone%20and%20PM2.5_Contributions.xls) account for all of Missouri's NO_X and SO_2 emissions (all anthropogenic source categories statewide, including point, area, and mobile sources). The results show that all of Missouri's NO_X and SO_2 emissions contribute 1.223 $\mu g/m^3$ to the design value at the Granite City monitor in the 2012 base case. In other words, EPA's modeling indicates that eliminating 100% of Missouri's anthropogenic NO_X and SO_2 emissions statewide would only reduce the annual $PM_{2.5}$ design value at the Granite City monitor by 1.223 $\mu g/m^3$. Considering the 2010-2012 design value at this site is 13.5 µg/m3, zeroing out all NO_X and SO_2 emissions in the entire state of Missouri is still not enough to bring the area into attainment of the NAAQS. It is important to note, that this is based on statewide emissions, meaning the contribution from NO_X and SO_2 sources located in the Missouri portion of the St. Louis MSA would likely only be a fraction of this value. The department is unaware of any source apportionment modeling that has been performed to determine the impact of just St. Louis area sources in Missouri on the $PM_{2.5}$ concentrations recorded at the Granite City monitor.

As demonstrated in Section 5 of this Appendix, when the single source located near the Granite City monitor was temporarily shut down for a year in 2009, this alone was enough to bring the area's annual average under 12.0 $\mu g/m^3$ (back when the quarterly average concentrations at the monitor before and after the shutdown were 18.7 $\mu g/m^3$ and 14.2 $\mu g/m^3$, respectively). While regional controls in Missouri and across the rest of the country will help to lower background concentrations and interstate contribution to $PM_{2.5}$ concentrations it is clear that the vast majority of the $PM_{2.5}$ increment above the regional background levels experienced at the Granite City monitor are the result of this single source, and are negligibly impacted by nearby sources in Missouri.

As another consideration, U.S. Steel received a revised construction permit to install pollution control equipment at their facility in March of 2013 (http://www.epa.state.il.us/public-notices/2008/us-steel/sig-mod/revised/us-steel-final-revised-permit.pdf). While it is unclear

exactly what controls have been installed thus far, the average annual $PM_{2.5}$ concentrations year-to-date in 2013 have declined in Granite City. Through July, 31, 2013 the annual average concentration at the Granite City monitor is only 11.4 µg/m^3, which lends further support that this source is the sole significant contributor to the $PM_{2.5}$ increment experienced at the Granite City monitor.

9. Conclusion

In conclusion, when considering monitoring data, emissions data, meteorology, and the analysis of $PM_{2.5}$ concentrations during and surrounding the period of the shutdown of the U.S. Steel Facility in Granite City, it is clear that local sources in Granite City in combination with background $PM_{2.5}$ concentrations across the Midwest Region are causing the violation at the Granite City Monitor. The Blair Street Monitor, which is just a few miles upwind of the U.S. Steel Facility when wind is blowing from the south, shows average $PM_{2.5}$ concentrations 10% – 15% lower than the concentrations at the Granite City monitor, which is only a few hundred yards downwind of the facility on these same days. In addition, the comparison of the U.S. Steel facility's direct $PM_{2.5}$ and $PM_{2.5}$ precursor emissions to the $PM_{2.5}$ concentrations measured at the Granite City monitor from 2000 – 2012 show the impact that emissions from this facility have on $PM_{2.5}$ concentrations in Granite City. Furthermore, analysis of the periods before, during, and after the shutdown of this facility in 2009, shows that total average $PM_{2.5}$ concentrations recorded by the Granite City monitor dropped by over 30% during the period of shutdown, due to reductions of approximately 30% and 76% of organic carbon and crustal particulate species, respectively. This resulted in an annual average $PM_{2.5}$ concentration well below the level of the NAAQS during the period of shutdown.

Meteorology data supports this same conclusion that when winds are calm or are blowing from the south making the Granite City monitor downwind from the two nearby Illinois sources, this results in the highest $PM_{2.5}$ concentrations at the site and when winds are blowing from the northwest and the monitor is upwind of these two sources, this results in the lowest concentrations at the site. While wind directions do not indicate that there is a significant southwesterly component on high days, HYSPLIT modeling indicates that air masses traveling from southwest of the monitor may be passing over some Missouri sources on some of the high PM concentration days. However, these sources are not believed to be causing the elevated concentrations at the Granite City monitor, but rather contributing to regionally dispersed $PM_{2.5}$ concentrations.

Through the review of emissions data from 2008 and 2011, Missouri sources comprise a large percent of the region's overall emissions inventory. However, $PM_{2.5}$ is a complicated pollutant. There are both direct and indirect $PM_{2.5}$ emissions. Direct emissions contribute significantly to the concentrations to the immediate local area, and indirect emissions depending on the precursor pollutant being analyzed can come from hundreds of miles away before forming particulate at ground-level, or emissions could form at ground-level in the immediate local area based on meteorological conditions. Therefore it is difficult to draw a conclusion based on emissions data alone, but the data clearly does not support a conclusion that controlling Missouri sources of emissions will have any type of noticeable impact on the monitor located in Granite City.

The review of controls in place in Missouri in the St. Louis area along with the expected future controls that will help control emissions in the area indicates that a nonattainment designation for Missouri likely would not result in any more controls for the area other than the controls that will be required regardless of the designation for the area. Furthermore, because Missouri has no authority over the sources that are believed to be causing this violation, there would be little Missouri could do to improve the $PM_{2.5}$ concentrations being recorded in Granite City.

Through this weight of evidence analysis performed to evaluate the $PM_{2.5}$ concentrations at the Granite City monitor, Missouri's recommendation is not to include any Missouri counties in the nonattainment area that will result from the violating monitor located in Granite City, Illinois. The trend analysis for the St. Louis area $PM_{2.5}$ monitors shows that $PM_{2.5}$ concentrations have been on the decline over the past decade as a result of permanent regional and local controls that have been implemented, and this trend is only expected to continue for the region as new federal control measures continue to be phased in. If it is determined that Missouri sources are contributing to the violation in Granite City, then this contribution would be better addressed through an interstate transport SIP because any contribution from Missouri would be best described as regional contribution and not "nearby" as is required to be included in a nonattainment area if there are no violating monitors in the area in question. This analysis clearly supports the fact that there are "nearby" sources in close proximity to this monitor located in Illinois that are causing this violation.

Missouri Department of Natural Resources

Appendix B

Evaluation of the IEPA-RAPS Trailer $PM_{2.5}$ Monitor Located in East St. Louis, Illinois (AQS Site ID: 17-163-0010)

Table of Contents

List of Tables

List of Figures

Evaluation of the IEPA-RAPS Trailer $PM_{2.5}$ Monitor Located in East St. Louis, Illinois (AQS Site ID: 17-163-0010)

1. Background and Approach

1.1 Fine Particulate Matter Background Information

Fine Particulate Matter ($PM_{2.5}$) is one of seven different criteria pollutants for which EPA has established a National Ambient Air Quality Standard (NAAQS). This pollutant includes all particles, both solid and liquid, that have an aerodynamic diameter less than 2.5 micrometers. For this reason, there is no single chemical formula for $PM_{2.5}$. Instead, $PM_{2.5}$ is comprised of dozens of different chemical species. Additionally, $PM_{2.5}$ can be emitted directly (primary $PM_{2.5}$), or it can be formed through chemical reactions of precursor pollutants in the atmosphere (secondary $PM_{2.5}$).

Primary $PM_{2.5}$ includes all nongaseous particles with aerodynamic diameters less than 2.5 micrometers in size that are emitted directly from an emissions source. Examples of primary $PM_{2.5}$ include microscopic dust particles; oxides of metals from milling and smelting operations; organic carbon particles from the combustion of fossil fuels and biomass; and other microscopic particles that are not fully combusted during combustion processes. The three speciation categories most heavily impacted by primary $PM_{2.5}$ emissions include organic carbon particulates, elemental carbon particulates, and crustal particulates. Primary $PM_{2.5}$ emissions have an immediate impact on ambient $PM_{2.5}$ concentrations in the local area surrounding the emissions source; however, as distance from the emissions source increases, the $PM_{2.5}$ concentrations resulting from the primary $PM_{2.5}$ emissions quickly disperse bringing $PM_{2.5}$ concentrations back down to regional/local background levels only a few miles away from the primary $PM_{2.5}$ emissions source. Under low and calm wind conditions, primary $PM_{2.5}$ emissions cannot disperse and buildups of $PM_{2.5}$ concentrations can occur around sources of primary $PM_{2.5}$ emissions.

Secondary $PM_{2.5}$ includes several different chemical species, each of which forms under different conditions. The three speciation categories most heavily impacted by secondary $PM_{2.5}$ include sulfates, nitrates, and organic carbon particulates. Sulfates are formed from sulfur dioxide (SO_2) emissions from power plants and industrial facilities. Nitrates are formed from emissions of nitrogen oxides (NO_X) from power plants, automobiles, and other combustion sources. Secondary organic particulates result from gaseous organic emissions from mobile and stationary fossil fuel combustion sources, industrial chemicals, gasoline evaporation, and biogenic emissions. Secondary $PM_{2.5}$ formation is a process that can take hours or days and is primarily responsible for long-range transportation contribution to $PM_{2.5}$ levels in other areas.

Sources of primary $PM_{2.5}$ include the following:

- Stationary sources that burn fossil fuels:
  - Organic carbon particles and elemental carbon particles from power plants, industrial/commercial/residential heating/combustion equipment
  - Oxides of trace metals from coal or oil combustion
- Mobile sources that burn fossil fuels:
  - Organic carbon particles and elemental carbon particles from the exhaust of cars, trucks, buses, locomotives, marine engines, and off-road equipment
  - Fugitive dust from on-road and off-road vehicles/equipment
- Industrial processes:
  - Organic carbon particles, elemental carbon particles, and oxides of metals from smelting, milling, and asphalt production
- Construction activities:
  - Fugitive dust from construction/earth moving activities
  - Organic carbon particles and elemental carbon particles from the exhaust of off-road equipment
- Agricultural operations:
  - Fugitive dust from earth moving/agricultural tilling
  - Organic carbon particles and elemental carbon particles from the exhaust of off-road farming equipment
- Non-anthropogenic sources:
  - Organic carbon particles and elemental carbon particles from wild fires

Sources of secondary $PM_{2.5}$ precursors that react in the air to form secondary $PM_{2.5}$ include:

- Stationary sources that burn fossil fuels
  - SO_2, NO_X, and gaseous organic emissions from power plants, industrial/commercial/residential heating/combustion equipment
- Mobile sources that burn fossil fuels
  - SO_2, NO_X, and gaseous organic emissions from exhaust of cars, trucks, buses, locomotives, marine engines, and off-road equipment
  - Gaseous organic emissions from gasoline/diesel fuel evaporation
- Gasoline fueling and refining
  - SO_2, NO_X, and gaseous organic emissions from refining operations
  - Gaseous organic emissions from gasoline/diesel fuel evaporation
- Surface coating operations
  - Gaseous organic emissions from solvent evaporation
- Industrial processes
  - SO_2, NO_X, and gaseous organic emissions from fossil fuel combustion
  - Gaseous organic emissions from solvent/chemical/liquid fuel evaporation
- Agricultural operations
  - Ammonia (NH_3) and gaseous organic emissions from fertilizers/animal feeding operations
  - SO_2, NO_X, and gaseous organic emissions from exhaust of off-road farming equipment
- Mining
  - Gaseous organic emissions from vented mine shafts
- Biogenic Sources
  - NH_3, NO_X, and gaseous organic emissions from vegetative and biological processes

1.2 2012 Annual $PM_{2.5}$ NAAQS

On January 15, 2013, EPA promulgated $PM_{2.5}$ air quality standards (78 FR 3036). These standards were based on a number of health studies showing that increased exposure to $PM_{2.5}$ is correlated with increased mortality and a range of serious health effects, including aggravation of lung disease, asthma attacks, and heart problems. EPA established a new primary standard for $PM_{2.5}$. The standard is based on an annual average and is set at a level of 12 micrograms per cubic meter ($\mu g/m^3$). Under the same action, EPA retained the existing secondary annual standard for $PM_{2.5}$, the existing primary and secondary 24-hour standards for $PM_{2.5}$, as well the existing primary and secondary standards for particulate matter with aerodynamic diameters of 10 microns or less (PM_{10}).

In the St. Louis area, there are two (2) $PM_{2.5}$ air quality monitors that are suitable for comparison with the annual $PM_{2.5}$ NAAQS and are currently violating the newly established $PM_{2.5}$ standard. Both of these monitors are located in Illinois. Per the Clean Air Act Amendments of 1990, any area with a monitor that has a design value in violation of a NAAQS is to be designated nonattainment. Additionally, nearby areas with sources that are contributing to the violation shall be included in the nonattainment area that results from the violating monitor. This Appendix evaluates one of these violating monitors located in East St. Louis, Illinois in an effort to determine the sources that are causing/contributing to the violation.

1.3 Evaluation Approach

In an effort to determine the contributing sources to the ambient fine particulate matter ($PM_{2.5}$) concentrations recorded by the "IEPA-RAPS Trailer" $PM_{2.5}$ monitor located in St. Clair County, East St. Louis, Illinois (hereafter referred to as the East St. Louis monitor) with a 2010 – 2012 annual $PM_{2.5}$ design value in violation of the 2012 Annual $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS), the Missouri Department of Natural Resources has performed an evaluation of the following: monitoring data from the East St. Louis Monitor and other ambient $PM_{2.5}$ monitors located in the MSA, the emissions sources located in the MO/IL St. Louis MSA, seasonal variations in monitored concentrations at the site, the wind directions on days with the top 20% and bottom 20% recorded 24-hour $PM_{2.5}$ concentrations at the East St. Louis monitor from 2010 – 2012, and modeled wind trajectories for these same days.

1.4 Episode Days Evaluated

Much of the evaluation performed to determine the contributing sources to the current violation at the East St. Louis monitor focused on a set of days during 2010 – 2012 when monitored $PM_{2.5}$ concentrations were at their highest and lowest. The high days were selected for evaluation as these days drive the annual average higher contributing significantly to the violation of the 2012 annual $PM_{2.5}$ standard. The low days were selected to determine if certain meteorological conditions tend to result in lower ambient $PM_{2.5}$ concentrations at this particular monitor. For both the high and low days the highest and lowest 20 percent 24-hour value concentrations recorded at this monitor in each year from 2010 – 2012 were evaluated. The value of 20 percent equates to 11 days in the year as this monitor recorded $PM_{2.5}$ concentrations an average of 56 days per year during the 2010 – 2012 time frame. This was determined to be both a sufficient and manageable number of episode days to evaluate to ensure that enough data is used to get representative trends, while keeping the amount of resources necessary for the evaluation at a manageable level.

Table 1 lists the dates that were used as episode days throughout much of this evaluation.

Table 1. Episode Days Evaluated at the East St. Louis Monitor

East St. Louis High Days			East St. Louis Low Days		
2010	2011	2012	2010	2011	2012
12/10/2010	1/3/2011	11/17/2012	6/7/2010	8/25/2011	5/3/2012
12/28/2010	6/8/2011	1/10/2012	8/30/2010	4/27/2011	6/26/2012
3/9/2010	1/27/2011	9/6/2012	6/19/2010	10/18/2011	4/21/2012
8/24/2010	7/2/2011	6/8/2012	5/2/2010	4/15/2011	3/22/2012
10/11/2010	5/27/2011	7/8/2012	3/15/2010	10/30/2011	11/11/2012
2/1/2010	1/15/2011	12/29/2012	1/8/2010	11/17/2011	6/2/2012
12/4/2010	12/5/2011	1/22/2012	4/26/2010	9/6/2011	9/24/2012
2/23/2010	8/1/2011	3/28/2012	9/11/2010	11/29/2011	2/21/2012
4/14/2010	9/12/2011	8/7/2012	4/8/2010	2/2/2011	2/3/2012
8/12/2010	3/10/2011	12/17/2012	5/8/2010	5/15/2011	11/23/2012
11/16/2010	5/9/2011	12/23/2012	2/7/2010	9/30/2011	10/24/2012

2. $PM_{2.5}$ Design Values at St. Louis Area $PM_{2.5}$ Monitors

2.1 2010 – 2012 Annual $PM_{2.5}$ Design Values in the Illinois/Missouri St. Louis MSA

To begin the evaluation, the 2010 – 2012 annual $PM_{2.5}$ design values at all monitors located in Missouri and Illinois were reviewed. All monitoring data used throughout this Appendix was pulled from EPA's Air Quality System (AQS). Figure 1 displays a map of the $PM_{2.5}$ monitoring network in the MO/IL St. Louis MSA. The $PM_{2.5}$ annual design values from 2010 – 2012 are listed below in Table 2. A quick review of the design values shows that all monitors located on the Missouri side of the St. Louis MSA that are suitable for comparison to the annual $PM_{2.5}$ NAAQS are in compliance with the 2012 annual $PM_{2.5}$ standard, while two monitors located in Illinois have 2010 – 2012 design values above the level of the standard. This evaluation focuses on the violating monitor located in East St. Louis, Illinois. A separate evaluation was performed for the violating monitor located in Granite City, Illinois, which can be found in Appendix A.

Table 2. 2010 – 2012 Design Values at Monitors Located in the St. Louis MSA *

Annual $PM_{2.5}$ Monitoring Data (all values in micrograms/cubic meter ($\mu g/m^3$)) **

Missouri Monitors			
Site Location	**AQS Site ID**	**County**	**2010 - 2012 Annual Design Value**
Arnold West	29-099-0019	Jefferson	10.1
South Broadway	29-510-0007	St. Louis City	11.0
Blair Street	29-510-0085	St. Louis City	11.7
Ladue	29-189-3001	St. Louis County	10.9
Illinois Monitors			
Site Location	**AQS Site ID**	**County**	**2010 - 2012 Design Value**
Alton	17-119-2009	Madison	11.8
Wood River	17-119-3007	Madison	11.6
East St. Louis	17-163-0010	St. Clair	12.2
Granite City	17-119-1007	Madison	13.5

* Note: Monitoring data was pulled from Federal Equivalent Method (FEM) and Federal Reference Method (FRM) $PM_{2.5}$ air quality monitors in the St. Louis area that are acceptable for comparison to the Annual $PM_{2.5}$ NAAQS, per EPA's July 2013 Air Quality Design Value Review: http://www.epa.gov/ttn/analysis/dvreview.htm

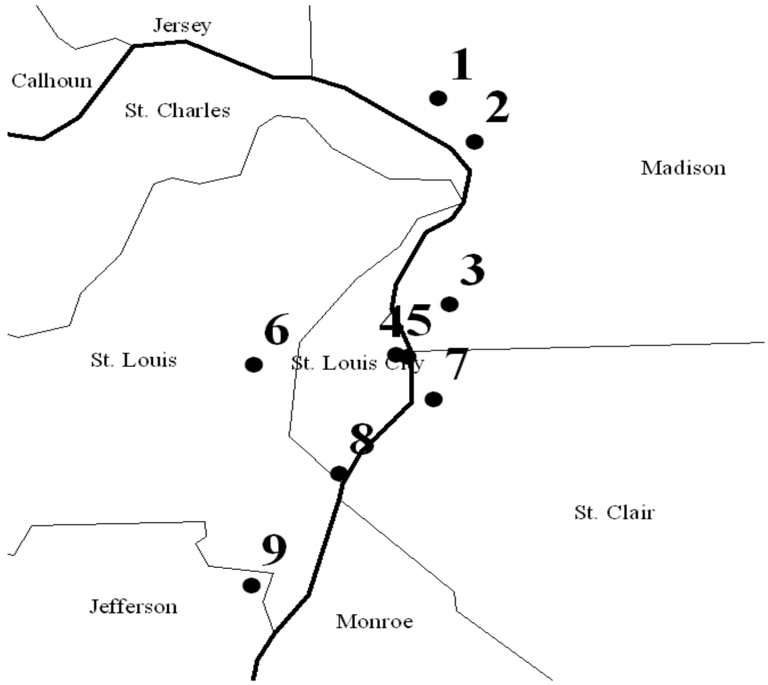
** Note: All values have been rounded to the nearest 0.1 microgram/cubic meter

Figure 1. Illinois/Missouri St. Louis MSA $PM_{2.5}$ Monitoring Network

Missouri	
Site #	**Site Location**
4	Blair Street
5	Branch Street *
6	Ladue
8	South Broadway
9	Arnold West

* Note: middle-scale monitor not comparable to Annual $PM_{2.5}$ NAAQS

Illinois	
Site #	**Site Location**
1	Alton
2	Wood River
3	Granite City
7	East St. Louis



Note: The Branch Street monitor is defined as a unique middle scale monitor and has been given a legacy exemption meaning it is not comparable to the 2012 Annual $PM_{2.5}$ NAAQS, per EPA's July 2013 Air Quality Design Value Review: http://www.epa.gov/ttn/analysis/dvreview.htm. This monitor is not representative of area-wide $PM_{2.5}$ concentrations as many of the episodes and trends recorded at the Branch Street monitor are unique to this location and not experienced across the St. Louis Region even by the neighborhood scale Blair Street monitor, which is less than 800 m from the Branch Street monitor location. Therefore, while trends and episodes at this monitor are useful and relevant for comparison and analysis of the 24-hour $PM_{2.5}$ NAAQS, the episodes and design values at this monitor are not suitable for comparison and analysis of the Annual $PM_{2.5}$ NAAQS. For additional details regarding the Branch Street monitor's status as a unique middle scale monitor, please see Appendix C.

2.2 Annual Average $PM_{2.5}$ Concentration Trends in the Illinois/Missouri St. Louis Area (2002 – 2013 year-to-date)

It is important to note that as a result of federal and local control measures in place in the St. Louis area on both the Illinois and Missouri sides, along with regional emission control measures that have been implemented across the country, average annual $PM_{2.5}$ concentrations have been declining steadily in the St. Louis over the past several years. Table 3 shows the annual average concentrations at the neighborhood scale monitoring sites listed above in Table 2 for each year from 2002 through 2012 and also includes the year-to-date annual average concentrations for 2013. For the Illinois monitors, AQS was used for the year-to-date 2013 data. All Illinois monitors have reported data through 7/31/13. It is noted that none of the data for 2013 has yet been certified and submitted to EPA, which will not happen until May 2014. For the Missouri monitors the 2013 year-to-date data is based on air quality monitoring data at FEM and FRM monitors that are used for comparison to the annual $PM_{2.5}$ NAAQS. The Missouri 2013 year-to-date data covers the time period from 1/1/13 – 9/16/13. This data has also not yet been quality assured or certified. Table 3 also includes the 2013 critical value for the annual average $PM_{2.5}$

concentration at each monitor. If the annual average $PM_{2.5}$ concentration at any of these monitors in 2013 is greater than or equal to the critical value it would trigger a violation of 2012 Annual $PM_{2.5}$ NAAQS at the respective monitor.

As seen in Table 3, the 2013 critical value for the East St. Louis monitor is 12.5 $\mu g/m^3$, and the year-to-date annual average is only 11.0 $\mu g/m^3$. It is noted, that the 2013 year-to-date average for East St. Louis is only based on seven months' worth of monitoring data, and therefore it is still too early to tell if the monitor will come into compliance with the 2012 Annual $PM_{2.5}$ NAAQS. However, considering the critical value at the East St. Louis monitor and the fact that the year-to-date annual average over 7 months is 11.0 $\mu g/m^3$, the monitor would need to average a $PM_{2.5}$ concentration of 14.48 $\mu g/m^3$ or higher in the remaining five months of the year in order to violate the standard. Additionally, as seen in Table 3, the average annual $PM_{2.5}$ concentrations across the St. Louis area have been on a declining trend over the past decade indicating that air quality across the region is steadily improving. Taking all of these factors into consideration, it is very possible that the East St. Louis monitor could come into compliance with the 2012 Annual $PM_{2.5}$ NAAQS once 2013 is over and the more recent monitoring data is factored into the design value at this monitor.

Table 3. St. Louis Area Annual Average $PM_{2.5}$ Concentrations (2002 – 2013 year-to-date) ($\mu g/m^3$) *														
Missouri Monitors														
Monitor Location	**AQS Site ID**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009 ******	**2010**	**2011**	**2012**	**2013 (ytd) ****	**2013 Critical Value**
Arnold West	29-099-0019	15.1	13.9	12.6	15.4	12.6	13.8	12.2	10.5	10.5	9.9	9.8	10.1	16.5
South Broadway	29-510-0007	15.3	14.4	13.1	15.9	13.1	14.0	12.5	11.9	12.3	11.7	9.1	11.2	15.4
Blair Street	29-510-0085	15.4	14.1	13.2	16.1	13.4	13.9	12.7	11.5	12.6	11.9	10.5	11.0	13.8
Ladue	29-189-3001	14.6	13.6	12.2	15.5	11.8	13.1	12.0	11.1	11.2	10.6	10.8	11.9	14.8
Illinois Monitors														
Monitor Location	**AQS Site ID**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009 ******	**2010**	**2011**	**2012**	**2013 (ytd) *****	**2013 Critical Value**
Alton	17-119-2009	14.7	14.0	11.5	16	13.1	14.9	12.5	10.1	13.3	11.5	10.4	9.8	14.3
Wood River	17-119-3007	15.1	14.0	13.2	16	13.1	14.2	12.2	11.0	12.0	12.4	10.6	11.1	13.3
East St. Louis	17-163-0010	16.7	16.6	14.7	17.1	14.5	15.6	12.5	11.7	13.0	12.8	10.9	11.0	12.5
Granite City	17-119-1007	17.7	17.5	15.4	18.2	16.3	15.1	15.7	11.3	14.3	13.3	12.8	11.2	10.1

* Note: 2013 year-to-date annual averages at all monitors could increase or decrease as more monitoring days are recorded. All values have been rounded to the nearest 0.1 $\mu g/m^3$

** Note: Missouri 2013 year-to-date average is based on FEM/FRM monitoring data from 1/1/13 – 6/10/13. The data has not yet been quality assured or certified.

*** Note: Illinois 2013 year-to-date average is based on monitoring data reported to AQS. $PM_{2.5}$ monitoring data for the Illinois monitors include data from 1/1/13 – 7/31/13. The data has not yet been quality assured or certified.

**** Note: In 2009, a significant direct $PM_{2.5}$ and $PM_{2.5}$ precursor emissions source was shutdown throughout much of year. This resulted in lower annual average concentrations of $PM_{2.5}$ across the St. Louis Region. Additional information regarding an evaluation of this source and the temporary shutdown during 2009 can be found in Appendix A, Section 5 of the Missouri 2012 $PM_{2.5}$ Boundary Recommendations.

2.3 Monitoring Frequency at the East St. Louis Monitor

It must be taken into consideration that the FRM monitor located in East St. Louis used for comparison with the annual $PM_{2.5}$ NAAQS only monitors $PM_{2.5}$ concentration levels once every six days. This reduces the number of days that can be evaluated making it more difficult to determine the trends if any that are associated with elevated $PM_{2.5}$ concentrations being recorded by the monitor. In addition to being only a 1-6 day monitor, this site lacks a Chemical Speciation Network (CSN) monitor that could be used to evaluate the various species that comprise the $PM_{2.5}$ concentrations at this monitor. For these reasons, it is difficult to perform a conclusive evaluation to determine the sources that are causing/contributing to the violation at this monitor.

3. Emissions Data

3.1 Emissions Inventory Data

Tables 4 – 8 list the emissions of direct $PM_{2.5}$ and the $PM_{2.5}$ precursors, oxides of nitrogen (NO_X), oxides of sulfur (SO_X), volatile organic compounds (VOC), and ammonia (NH_3), respectively, for each county in the Illinois/Missouri St. Louis MSA in tons/year by source category for both 2008 and 2011. The point and area source emissions inventories listed in these tables for Missouri and Illinois were generated for submission to EPA for the National Emissions Inventory in these two years. Mobile source emissions in Missouri and Illinois were calculated by the Missouri Department of Natural Resources and the Illinois EPA. NONROAD 2008 was used to develop the non-road mobile source emissions with county specific data, and EPA's Motor Vehicle Emissions Simulator (MOVES) version 2010b was used to develop the on-road mobile source emissions with county specific data.

Area sources comprise a large percentage of direct $PM_{2.5}$ emissions from all counties in the MO/IL St. Louis MSA. However, a vast majority of the direct $PM_{2.5}$ emissions from area sources are calculated values for paved and unpaved roads and agricultural tilling. These emissions categories account for dust that is disturbed on roads by vehicles and in fields during agricultural tilling. These types of emissions are very local in nature, and quickly settle out of the air usually within 100 – 500 yards from their origin. Therefore, these types of emissions in Missouri, while significant to the overall percentage of direct $PM_{2.5}$ emissions in the MSA, would not have an impact on $PM_{2.5}$ concentrations recorded at the East St. Louis monitor. Although it is noted that a marginal percentage direct $PM_{2.5}$ emissions from paved and unpaved roads nearby the East St. Louis monitor in St. Clair County could have an impact on the $PM_{2.5}$ concentrations recorded by the East St. Louis monitor, the vast majority of direct $PM_{2.5}$ emissions from these three emissions source categories in the IL/MO St. Louis MSA are not impacting the $PM_{2.5}$ concentrations in East St. Louis. For this reason, direct $PM_{2.5}$ emissions from these three categories have been excluded from the area source category for all counties evaluated in Table 4 to allow for a more focused evaluation on emissions that may be impacting the violating monitor in East St. Louis.

As seen in the following tables, all the Missouri counties included in the MSA except for Lincoln and Warren have a significant amount of emissions from point, on-road, and non-road categories for all pollutants reviewed. There are also significant emissions on the Illinois side, particularly in Madison County and some pollutant categories in St. Clair County (the location of the East St. Louis Monitor), but generally speaking, the emissions from the Missouri side of the MSA comprise a majority from the entire MSA.

Looking at mobile source emissions from 2008 – 2011 shows a general decline in all emission categories evaluated from 2008 – 2011. This is the result of federal motor vehicle and non-road engine standards that have been phased in and the retirement of older higher polluting mobile source engines. In addition to federal motor vehicle emissions standards, Missouri implements reformulated gasoline requirements in the St. Louis area along with an inspection and maintenance (I/M) program for all vehicles registered in the City of St. Louis and the Counties of St. Louis, St. Charles, Franklin, and Jefferson. This I/M program ensures that vehicles in the

area fix the emission controls on their vehicles when they break and eliminates any attempts for residents to tamper with the emission control devices on their vehicles, thus ensuring the emissions reductions expected from the federal motor vehicle standards remain in place. Therefore, the trend of declining mobile source emissions is expected to continue in the St. Louis area.

When analyzing point source emissions, particularly for the pollutant categories of SO_X and NO_X, a vast majority of the emissions result from electric generating units, and are emitted from stacks hundreds of feet in the air. This results in dispersion and helps prevent high concentrations of these pollutants at ground-level. While these types of emissions do contribute to $PM_{2.5}$ concentrations as they undergo chemical reactions in the atmosphere, the $PM_{2.5}$ contribution can result hundreds of miles away from the actual emission source, so they contribute more to regional background levels than they do to the local MSA. These types of emissions sources have typically been controlled through regional emission programs aimed at reducing the impact of emissions on downwind state ambient air pollutant concentrations. As noted in the next subsection, there are not any local point sources in St. Clair County with emissions in 2011 exceeding 100 tons per year for direct $PM_{2.5}$ or any individual $PM_{2.5}$ precursor that are in close proximity to the East St. Louis monitor; however there are several sources with emissions that are not insignificant that could be causing or contributing to the elevated $PM_{2.5}$ concentrations in East St. Louis.

Based on the magnitude of emissions alone, Missouri sources comprise a large percent of the region's overall emissions inventory. However, aggregate emissions in the MSA alone are not enough to determine the relative contribution of these emission sources to a particular $PM_{2.5}$ monitor violation. Analysis of emission point elevations, release parameters, and meteorological data are needed to perform quantitative dispersion/photochemical modeling and source apportionment analysis. However, despite limitations in quantitatively correlating aggregate emissions to unique monitored concentrations, a weight of evidence approach is used in this document to analyze the likelihood of whether Missouri sources are causing or contributing to the magnitude of the violating monitor in East St. Louis. This approach is discussed in the sections that follow and is appropriate since area wide monitored violations do not occur over the entire MO/IL St. Louis MSA.

Table 4 Direct $PM_{2.5}$ Emissions and Percentages by County and Source Category in the Illinois/Missouri St. Louis MSA in 2008 and 2011 *										
	2008 Direct $PM_{2.5}$ Emissions (Tons/Year)					2011 Direct $PM_{2.5}$ Emissions (Tons/Year)				
Missouri	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
St. Louis	510.91	3,232.47	1,306.99	618.2	**5,668.57**	208.96	3,759.63	993.87	574.04	**5,536.50**
	9.41%	32.40%	42.26%	37.47%	**28.13%**	4.65%	30.80%	42.21%	38.07%	**26.93%**
St. Louis City	271.66	1,247.78	353.18	152.6	**2,025.22**	289.10	1,080.66	251.98	95.12	**1,716.86**
	5.00%	12.51%	11.42%	9.25%	**10.05%**	6.44%	8.85%	10.70%	6.31%	**8.35%**
St. Charles	316.21	630.05	302.58	205.09	**1,453.93**	445.05	1,120.96	313.41	180.06	**2,059.48**
	5.82%	6.32%	9.78%	12.43%	**7.22%**	9.91%	9.18%	13.31%	11.94%	**10.02%**
Jefferson	945.65	717.78	192.81	85.82	**1,942.06**	511.82	965.22	183.67	77.01	**1,737.72**
	17.42%	7.20%	6.23%	5.20%	**9.64%**	11.40%	7.91%	7.80%	5.11%	**8.45%**
Franklin	1,448.96	423.94	142.43	138.11	**2,153.44**	1,714.56	513.07	117.34	96.30	**2,441.27**
	26.68%	4.25%	4.61%	8.37%	**10.69%**	38.19%	4.20%	4.98%	6.39%	**11.87%**
Lincoln	0.27	222.5	41.46	65.30	**329.53**	0.33	255.15	44.99	44.69	**345.16**
	0.00%	2.23%	1.34%	3.96%	**1.64%**	0.01%	2.09%	1.91%	2.96%	**1.68%**
Warren	0.86	140.14	53.66	28.75	**223.41**	-	191.73	56.54	25.66	**273.93**
	0.02%	1.40%	1.74%	1.74%	**1.11%**	0.00%	1.57%	2.40%	1.70%	**1.33%**
Missouri MSA	**3,494.52**	**6,614.66**	**2,393.11**	**1,293.87**	**13,796.16**	**3,169.82**	**7,886.42**	**1,961.80**	**1,092.88**	**14,110.92**
	64.35%	**66.31%**	**77.38%**	**78.43%**	**68.47%**	**70.61%**	**64.60%**	**83.33%**	**72.48%**	**68.64%**
	2008 Direct $PM_{2.5}$ Emissions (Tons/Year)					2011 Direct $PM_{2.5}$ Emissions (Tons/Year)				
Illinois	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
Clinton	60.20	265.07	32.85	47.06	**405.18**	48.22	289.05	20.89	50.61	**408.77**
	1.11%	2.66%	1.06%	2.85%	**2.01%**	1.07%	2.37%	0.89%	3.36%	**1.99%**
Jersey	0.87	151.43	17.98	25.99	**196.27**	0.00	147.72	9.44	27.70	**184.86**
	0.02%	1.52%	0.58%	1.58%	**0.97%**	0.00%	1.21%	0.40%	1.84%	**0.90%**
Madison	1,781.41	1,492.74	311.41	142.27	**3,727.84**	1,232.23	1,438.24	176.97	154.79	**3,002.23**
	32.81%	14.96%	10.07%	8.62%	**18.50%**	27.45%	11.78%	7.52%	10.27%	**14.60%**
Monroe	3.35	268.6	38.36	31.25	**341.57**	0.51	228.94	20.26	59.62	**309.33**
	0.06%	2.69%	1.24%	1.89%	**1.70%**	0.01%	1.88%	0.86%	3.95%	**1.50%**
St. Clair	89.73	1,182.78	298.97	109.30	**1,680.78**	38.32	2,217.24	165.03	122.19	**2,542.77**
	1.65%	11.86%	9.67%	6.63%	**8.34%**	0.85%	18.16%	7.01%	8.10%	**12.37%**
Illinois MSA	**1,935.56**	**3,360.62**	**699.58**	**355.88**	**6,351.64**	**1,319.28**	**4,321.19**	**392.58**	**414.92**	**6,447.97**
	35.65%	**33.69%**	**22.62%**	**21.57%**	**31.53%**	**29.39%**	**35.40%**	**16.67%**	**27.52%**	**31.36%**
MSA Total	**5,430.08**	**9,975.28**	**3,092.69**	**1,649.75**	**20,147.80**	**4,489.10**	**12,207.61**	**2,354.38**	**1,507.80**	**20,558.89**

* Note: The percentages listed in the table above indicate each area's percentage of the total IL/MO St. Louis MSA Direct $PM_{2.5}$ emissions during the applicable year for the applicable source category. This table does not include direct $PM_{2.5}$ emissions from paved and unpaved roads or agricultural tilling operations.

Table 5 NO$_X$ Emissions and Percentages by County and Source Category in the Illinois/Missouri St. Louis MSA in 2008 and 2011 *										
	2008 NO$_X$ Emissions (Tons/Year)					2011 NO$_X$ Emissions (Tons/Year)				
Missouri	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
St. Louis	5,843.52	2,219.83	33,985.44	9,344.46	**51,393.25**	5,110.66	2,680.64	24,407.41	6,413.31	**38,612.02**
	12.84%	21.02%	42.75%	35.56%	**31.75%**	12.73%	39.44%	40.16%	30.61%	**30.01%**
St. Louis City	1,415.83	1,033.57	9,165.29	4,078.51	**15,693.20**	1,096.90	1,061.87	6,078.28	2,064.89	**10,301.94**
	3.11%	9.79%	11.53%	15.52%	**9.70%**	2.73%	15.62%	10.00%	9.86%	**8.01%**
St. Charles	7,649.32	461.25	8,119.75	3,043.73	**19,274.05**	7,369.86	626.90	7,761.68	2,178.97	**17,937.41**
	16.80%	4.37%	10.21%	11.58%	**11.91%**	18.36%	9.22%	12.77%	10.40%	**13.94%**
Jefferson	7,016.40	383.49	5,476.95	1,199.29	**14,076.13**	5,608.14	368.80	4,600.80	886.91	**11,464.65**
	15.41%	3.63%	6.89%	4.56%	**8.70%**	13.97%	5.43%	7.57%	4.23%	**8.91%**
Franklin	9,178.19	282.40	4,187.48	3,056.58	**16,704.65**	9,898.13	227.38	2,896.06	1,712.41	**14,733.98**
	20.16%	2.67%	5.27%	11.63%	**10.32%**	24.66%	3.35%	4.77%	8.17%	**11.45%**
Lincoln	37.29	74.97	1,398.85	1,166.46	**2,677.57**	29.56	89.00	1,326.74	618.41	**2,063.71**
	0.08%	0.71%	1.76%	4.44%	**1.65%**	0.07%	1.31%	2.18%	2.95%	**1.60%**
Warren	10.24	78.27	1,740.09	385.24	**2,213.84**	0.11	57.09	1,553.57	298.03	**1,908.80**
	0.02%	0.74%	2.19%	1.47%	**1.37%**	0.00%	0.84%	2.56%	1.42%	**1.48%**
Missouri MSA	**31,150.79**	**4,533.78**	**64,073.85**	**22,274.27**	**122,032.69**	**29,113.36**	**5,111.68**	**48,624.54**	**14,172.93**	**97,022.51**
	68.43%	**42.94%**	**80.59%**	**84.77%**	**75.39%**	**72.54%**	**75.20%**	**80.01%**	**67.65%**	**75.42%**
	2008 NO$_X$ Emissions (Tons/Year)					2011 NO$_X$ Emissions (Tons/Year)				
Illinois	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
Clinton	2,338.04	747.56	1,050.72	588.95	**4,725.27**	3,025.57	131.99	688.74	750.24	**4,596.53**
	5.14%	7.08%	1.32%	2.24%	**2.92%**	7.54%	1.94%	1.13%	3.58%	**3.57%**
Jersey	0.04	319.44	513.01	281.28	**1,113.77**	-	67.98	323.13	466.31	**857.42**
	0.00%	3.03%	0.65%	1.07%	**0.69%**	0.00%	1.00%	0.53%	2.23%	**0.67%**
Madison	11,384.21	1,869.27	6,722.10	1,586.61	**21,562.18**	7,648.65	731.19	5,411.02	2,258.69	**16,049.56**
	25.01%	17.70%	8.46%	6.04%	**13.32%**	19.06%	10.76%	8.90%	10.78%	**12.48%**
Monroe	10.86	1,328.75	832.78	359.07	**2,531.46**	8.25	108.04	654.08	1,452.80	**2,223.18**
	0.02%	12.58%	1.05%	1.37%	**1.56%**	0.02%	1.59%	1.08%	6.93%	**1.73%**
St. Clair	635.92	1,759.76	6,309.87	1,187.16	**9,892.71**	337.23	646.36	5,069.61	1,848.07	**7,901.27**
	1.40%	16.67%	7.94%	4.52%	**6.11%**	0.84%	9.51%	8.34%	8.82%	**6.14%**
Illinois MSA	**14,369.07**	**6,024.78**	**15,428.48**	**4,003.07**	**39,825.39**	**11,019.69**	**1,685.57**	**12,146.58**	**6,776.12**	**31,627.96**
	31.57%	**57.06%**	**19.41%**	**15.23%**	**24.61%**	**27.46%**	**24.80%**	**19.99%**	**32.35%**	**24.58%**
MSA Total	**45,519.86**	**10,558.56**	**79,502.33**	**26,277.34**	**161,858.08**	**40,133.05**	**6,797.25**	**60,771.12**	**20,949.05**	**128,650.47**

* Note: The percentages listed in the table above indicate each area's percentage of the total IL/MO St. Louis MSA NO$_X$ emissions during the applicable year for the applicable source category.

Table 6 SO_X Emissions and Percentages by County and Source Category in the Illinois/Missouri St. Louis MSA in 2008 and 2011										
	2008 SO_X Emissions (Tons/Year)					2011 SO_X Emissions (Tons/Year)				
Missouri	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
St. Louis	20,861.90	5,445.70	242.70	329.92	**26,880.22**	15,315.56	141.63	112.61	239.45	**15,809.25**
	9.18%	44.96%	45.54%	56.18%	**11.18%**	11.02%	25.17%	38.01%	50.92%	**11.27%**
St. Louis City	5,729.67	3,273.63	68.87	101.01	**9,173.18**	3,030.44	52.31	28.69	28.29	**3,139.73**
	2.52%	27.03%	12.92%	17.20%	**3.82%**	2.18%	9.30%	9.68%	6.02%	**2.24%**
St. Charles	48,595.17	895.18	55.44	57.55	**49,603.34**	5,323.84	33.58	34.81	49.67	**5,441.90**
	21.39%	7.39%	10.40%	9.80%	**20.63%**	3.83%	5.97%	11.75%	10.56%	**3.88%**
Jefferson	68,569.28	904.61	36.88	19.29	**69,530.06**	43,702.04	35.11	20.45	20.04	**43,777.64**
	30.18%	7.47%	6.92%	3.28%	**28.92%**	31.45%	6.24%	6.90%	4.26%	**31.20%**
Franklin	57,944.69	991.04	30.12	36.52	**59,002.37**	57,948.83	37.28	13.14	25.81	**58,025.06**
	25.50%	8.18%	5.65%	6.22%	**24.54%**	41.70%	6.63%	4.43%	5.49%	**41.36%**
Lincoln	0.06	87.53	9.36	29.67	**126.62**	0.04	16.00	10.88	12.11	**39.03**
	0.00%	0.72%	1.76%	5.05%	**0.05%**	0.00%	2.84%	3.67%	2.58%	**0.03%**
Warren	0.06	205.98	9.66	6.79	**222.49**	-	5.36	10.96	7.10	**23.42**
	0.00%	1.70%	1.81%	1.16%	**0.09%**	0.00%	0.95%	3.70%	1.51%	**0.02%**
Missouri MSA	**201,700.83**	**11,803.67**	**453.03**	**580.75**	**214,538.28**	**125,320.75**	**321.27**	**231.54**	**382.47**	**126,256.03**
	88.78%	**97.46%**	**85.01%**	**98.90%**	**89.23%**	**90.18%**	**57.10%**	**78.14%**	**81.34%**	**90.00%**
	2008 SO_X Emissions (Tons/Year)					2011 SO_X Emissions (Tons/Year)				
Illinois	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
Clinton	414.81	18.28	4.57	1.51	**439.17**	357.78	12.88	3.77	3.70	**378.14**
	0.18%	0.15%	0.86%	0.26%	**0.18%**	0.26%	2.29%	1.27%	0.79%	**0.27%**
Jersey	0.01	8.46	2.16	0.53	**11.16**	-	7.27	1.91	18.10	**27.28**
	0.00%	0.07%	0.41%	0.09%	**0.00%**	0.00%	1.29%	0.64%	3.85%	**0.02%**
Madison	24,956.78	136.62	35.35	2.16	**25,130.91**	13,136.21	101.01	28.49	15.00	**13,280.71**
	10.98%	1.13%	6.63%	0.37%	**10.45%**	9.45%	17.95%	9.62%	3.19%	**9.47%**
Monroe	0.19	34.75	4.40	0.66	**39.99**	0.10	11.17	3.58	38.72	**53.56**
	0.00%	0.29%	0.83%	0.11%	**0.02%**	0.00%	1.98%	1.21%	8.23%	**0.04%**
St. Clair	127.98	109.33	33.40	1.62	**272.34**	147.38	108.99	27.00	12.24	**295.62**
	0.06%	0.90%	6.27%	0.28%	**0.11%**	0.11%	19.37%	9.11%	2.60%	**0.21%**
Illinois MSA	**25,499.77**	**307.44**	**79.88**	**6.48**	**25,893.58**	**13,641.47**	**241.33**	**64.76**	**87.74**	**14,035.30**
	11.22%	**2.54%**	**14.99%**	**1.10%**	**10.77%**	**9.82%**	**42.90%**	**21.86%**	**18.66%**	**10.00%**
MSA Total	**227,200.60**	**12,111.11**	**532.91**	**587.23**	**240,431.86**	**138,962.22**	**562.60**	**296.30**	**470.21**	**140,291.33**

* Note: The percentages listed in the table above indicate each area's percentage of the total IL/MO St. Louis MSA SO_X emissions during the applicable year for the applicable source category.

Table 7 VOC Emissions and Percentages by County and Source Category in the Illinois/Missouri St. Louis MSA in 2008 and 2011										
	2008 VOC Emissions (Tons/Year)					2011 VOC Emissions (Tons/Year)				
Missouri	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
St. Louis	1,689.72	20,196.53	13,093.35	6,513.17	**41,492.77**	615.49	16,227.59	7,769.30	5,936.10	**30,548.48**
	17.87%	27.66%	42.86%	39.72%	**32.06%**	8.29%	40.58%	39.62%	43.89%	**37.93%**
St. Louis City	1,155.67	7,656.98	3,278.08	1,146.65	**13,237.38**	852.38	5,095.47	1,668.63	985.94	**8,602.42**
	12.22%	10.49%	10.73%	6.99%	**10.23%**	11.49%	12.74%	8.51%	7.29%	**10.68%**
St. Charles	936.97	5,758.92	3,663.73	1,934.74	**12,294.36**	802.09	4,791.81	2,627.92	1,700.07	**9,921.89**
	9.91%	7.89%	11.99%	11.80%	**9.50%**	10.81%	11.98%	13.40%	12.57%	**12.32%**
Jefferson	600.04	3,127.96	2,552.86	914.76	**7,195.62**	483.33	3,157.62	1,637.25	846.05	**6,124.25**
	6.35%	4.28%	8.36%	5.58%	**5.56%**	6.51%	7.90%	8.35%	6.26%	**7.60%**
Franklin	685.48	1,603.65	1,574.13	1,036.21	**4,899.47**	640.66	1,469.19	912.88	918.33	**3,941.06**
	7.25%	2.20%	5.15%	6.32%	**3.79%**	8.63%	3.67%	4.66%	6.79%	**4.89%**
Lincoln	79.04	880.44	744.21	520.81	**2,224.50**	66.11	909.00	494.68	444.22	**1,914.01**
	0.84%	1.21%	2.44%	3.18%	**1.72%**	0.89%	2.27%	2.52%	3.28%	**2.38%**
Warren	171.17	674.21	633.81	272.85	**1,752.04**	206.12	663.71	448.78	231.33	**1,549.94**
	1.81%	0.92%	2.07%	1.66%	**1.35%**	2.78%	1.66%	2.29%	1.71%	**1.92%**
Missouri MSA	**5,318.09**	**39,898.69**	**25,540.17**	**12,339.19**	**83,096.14**	**3,666.18**	**32,314.39**	**15,559.44**	**11,062.04**	**62,602.05**
	56.24%	**54.64%**	**83.60%**	**75.24%**	**64.20%**	**49.41%**	**80.82%**	**79.34%**	**81.80%**	**77.73%**
	2008 VOC Emissions (Tons/Year)					2011 VOC Emissions (Tons/Year)				
Illinois	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
Clinton	155.87	4,583.87	428.35	959.02	**6,127.11**	208.70	623.59	253.05	338.31	**1,423.65**
	1.65%	6.28%	1.40%	5.85%	**4.73%**	2.81%	1.56%	1.29%	2.50%	**1.77%**
Jersey	9.74	4,445.62	208.14	336.64	**5,000.14**	7.44	377.85	129.21	166.99	**681.49**
	0.10%	6.09%	0.68%	2.05%	**3.86%**	0.10%	0.94%	0.66%	1.23%	**0.85%**
Madison	3,215.56	9,849.25	2,116.34	1,459.46	**16,640.61**	2,985.15	3,230.54	1,762.02	1,059.03	**9,036.73**
	34.01%	13.49%	6.93%	8.90%	**12.86%**	40.23%	8.08%	8.99%	7.83%	**11.22%**
Monroe	18.17	4,988.85	264.60	340.76	**5,612.38**	15.05	514.86	232.92	182.31	**945.14**
	0.19%	6.83%	0.87%	2.08%	**4.34%**	0.20%	1.29%	1.19%	1.35%	**1.17%**
St. Clair	738.10	9,259.40	1,994.64	964.34	**12,956.47**	537.71	2,924.06	1,673.50	714.89	**5,850.16**
	7.81%	12.68%	6.53%	5.88%	**10.01%**	7.25%	7.31%	8.53%	5.29%	**7.26%**
Illinois MSA	**4,137.43**	**33,127.00**	**5,012.06**	**4,060.22**	**46,336.71**	**3,754.04**	**7,670.91**	**4,050.70**	**2,461.52**	**17,937.17**
	43.76%	**45.36%**	**16.40%**	**24.76%**	**35.80%**	**50.59%**	**19.18%**	**20.66%**	**18.20%**	**22.27%**
MSA Total	**9,455.52**	**73,025.69**	**30,552.23**	**16,399.41**	**129,432.85**	**7,420.22**	**39,985.30**	**19,610.14**	**13,523.56**	**80,539.22**

* Note: The percentages listed in the table above indicate each area's percentage of the total IL/MO St. Louis MSA VOC emissions during the applicable year for the applicable source category.

Table 8 NH_3 Emissions and Percentages by County and Source Category in the Illinois/Missouri St. Louis MSA in 2008 and 2011

	2008 NH_3 Emissions (Tons/Year)					2011 NH_3 Emissions (Tons/Year)				
Missouri	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
St. Louis	720.41	1,036.69	582.99	7.33	**2,347.42**	666.26	718.37	369.32	7.46	**1,761.41**
	50.90%	8.51%	43.02%	36.28%	**15.68%**	54.31%	6.41%	38.09%	36.46%	**13.12%**
St. Louis City	568.40	129.50	169.20	2.21	**869.31**	514.75	148.42	94.89	1.47	**759.53**
	40.16%	1.06%	12.49%	10.94%	**5.81%**	41.96%	1.32%	9.79%	7.18%	**5.66%**
St. Charles	8.04	883.43	132.82	2.58	**1,026.87**	4.78	899.54	113.53	2.46	**1,020.31**
	0.57%	7.25%	9.80%	12.77%	**6.86%**	0.39%	8.02%	11.71%	12.02%	**7.60%**
Jefferson	8.97	165.26	90.42	1.06	**265.71**	7.61	175.35	66.35	1.03	**250.34**
	0.63%	1.36%	6.67%	5.25%	**1.77%**	0.62%	1.56%	6.84%	5.03%	**1.86%**
Franklin	2.82	1,300.09	77.75	1.74	**1,382.40**	3.07	1,265.49	43.05	1.23	**1,312.84**
	0.20%	10.67%	5.74%	8.61%	**9.23%**	0.25%	11.29%	4.44%	6.01%	**9.78%**
Lincoln	-	1,010.92	22.93	0.79	**1,034.64**	-	863.00	18.42	0.58	**882.00**
	0.00%	8.30%	1.69%	3.91%	**6.91%**	0.00%	7.70%	1.90%	2.83%	**6.57%**
Warren	0.77	681.24	28.70	0.34	**711.05**	-	647.55	21.77	0.32	**669.64**
	0.05%	5.59%	2.12%	1.68%	**4.75%**	0.00%	5.78%	2.25%	1.56%	**4.99%**
Missouri MSA	**1,309.41**	**5,207.13**	**1,104.81**	**16.05**	**7,637.40**	**1,196.47**	**4,717.72**	**727.33**	**14.55**	**6,656.07**
	92.52%	**42.75%**	**81.53%**	**79.43%**	**51.02%**	**97.53%**	**42.08%**	**75.01%**	**71.11%**	**49.56%**
	2008 NH_3 Emissions (Tons/Year)					2011 NH_3 Emissions (Tons/Year)				
Illinois	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**	**Point**	**Area**	**On-Road**	**Non-Road**	**Total**
Clinton	0.33	3,124.86	16.84	0.48	**3,142.51**	0.31	2,995.71	14.31	0.64	**3,010.98**
	0.02%	25.66%	1.24%	2.36%	**20.99%**	0.03%	26.72%	1.48%	3.15%	**22.42%**
Jersey	-	546.91	8.09	0.25	**555.24**	-	490.11	7.36	0.39	**497.86**
	0.00%	4.49%	0.60%	1.24%	**3.71%**	0.00%	4.37%	0.76%	1.92%	**3.71%**
Madison	82.99	1,233.37	109.94	1.74	**1,428.04**	23.49	1,113.03	106.17	2.21	**1,244.90**
	5.86%	10.13%	8.11%	8.63%	**9.54%**	1.91%	9.93%	10.95%	10.79%	**9.27%**
Monroe	0.12	870.42	13.77	0.34	**884.65**	0.16	808.97	13.52	0.92	**823.57**
	0.01%	7.15%	1.02%	1.66%	**5.91%**	0.01%	7.21%	1.39%	4.49%	**6.13%**
St. Clair	22.43	1,196.94	101.72	1.35	**1,322.45**	6.29	1,087.04	100.90	1.75	**1,195.97**
	1.59%	9.83%	7.51%	6.66%	**8.83%**	0.51%	9.69%	10.41%	8.54%	**8.91%**
Illinois MSA	**105.87**	**6,972.50**	**250.36**	**4.16**	**7,332.89**	**30.25**	**6,494.86**	**242.25**	**5.91**	**6,773.28**
	7.48%	**57.25%**	**18.47%**	**20.57%**	**48.98%**	**2.47%**	**57.92%**	**24.99%**	**28.89%**	**50.44%**
MSA Total	**1,415.28**	**12,179.63**	**1,355.17**	**20.21**	**14,970.29**	**1,226.72**	**11,212.58**	**969.58**	**20.46**	**13,429.35**

* Note: The percentages listed in the table above indicate each area's percentage of the total IL/MO St. Louis MSA NH_3 emissions during the applicable year for the applicable source category.

3.2 Emission Source Location

Emissions source location is important to determine if particular sources are impacting the concentrations at violating monitoring sites. Figure 2 provides a map with point sources in the Illinois/Missouri St. Louis MSA along with the location of the East St. Louis monitor. The map also includes one source located in the Baldwin Township of Randolph County, Illinois because this area was included in the 1997 St. Louis IL/MO $PM_{2.5}$ nonattainment area, and there is a significant emissions source located here. Each of the sources included in Figure 2 are numbered. These numbers correspond to the sources, which are listed according to these numbers in Table 9 along with the numeric emissions in 2011 for each of these sources. Table 9 also provides the distance in miles from each of these sources to the East St. Louis monitor.

Sources on the map include point sources with emissions in 2011 of 100 or more tons of direct $PM_{2.5}$ or any individual $PM_{2.5}$ precursor. The sources are sized by the total sum of all direct $PM_{2.5}$ and $PM_{2.5}$ precursor emissions in 2011. The smaller points indicate sources with fewer emissions, while the larger points on the map indicate sources with higher emissions as indicated in the legend. Missouri sources are shown in red on the map, while Illinois sources are shown in blue. The green dot on the map indicates the location of the East St. Louis monitor. Figure 3 provides a map with the same sources as Figure 2, but breaks the emissions from these sources into pollutant categories in order to show the specific pollutant(s) that is relevant to each source.

Figure 2

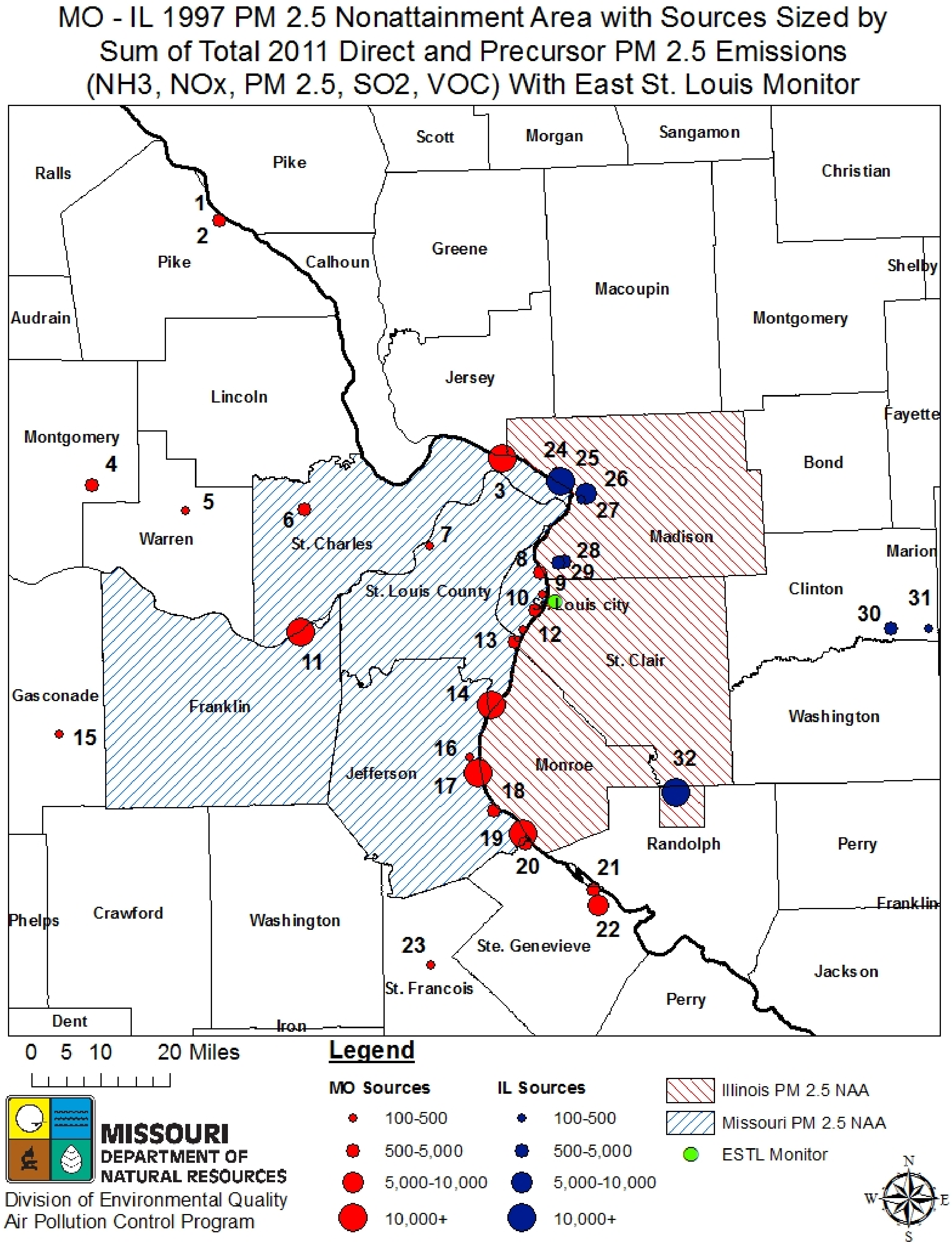

MO - IL 1997 PM 2.5 Nonattainment Area with Sources Sized by Sum of Total 2011 Direct and Precursor PM 2.5 Emissions (NH3, NOx, PM 2.5, SO2, VOC) With East St. Louis Monitor
Ralls
Pike
Scott
Morgan
Sangamon
Christian
Pike
Calhoun
Greene
Macoupin
Shelby
Montgomery
Audrain
Jersey
Lincoln
Fayette
Montgomery
Bond
Warren
St. Charles
Madison
Marion
St. Louis County
St. Louis city
Clinton
St. Clair
Gasconade
Franklin
Washington
Jefferson
Monroe
Randolph
Perry
Phelps
Crawford
Washington
Ste. Genevieve
Franklin
St. Francois
Jackson
Perry
Dent
Iron
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
0 5 10 20 Miles
Legend
MO Sources
100-500
500-5,000
5,000-10,000
10,000+
IL Sources
100-500
500-5,000
5,000-10,000
10,000+
Illinois PM 2.5 NAA
Missouri PM 2.5 NAA
ESTL Monitor
MISSOURI DEPARTMENT OF NATURAL RESOURCES
Division of Environmental Quality
Air Pollution Control Program
N
W
E
S

Figure 3

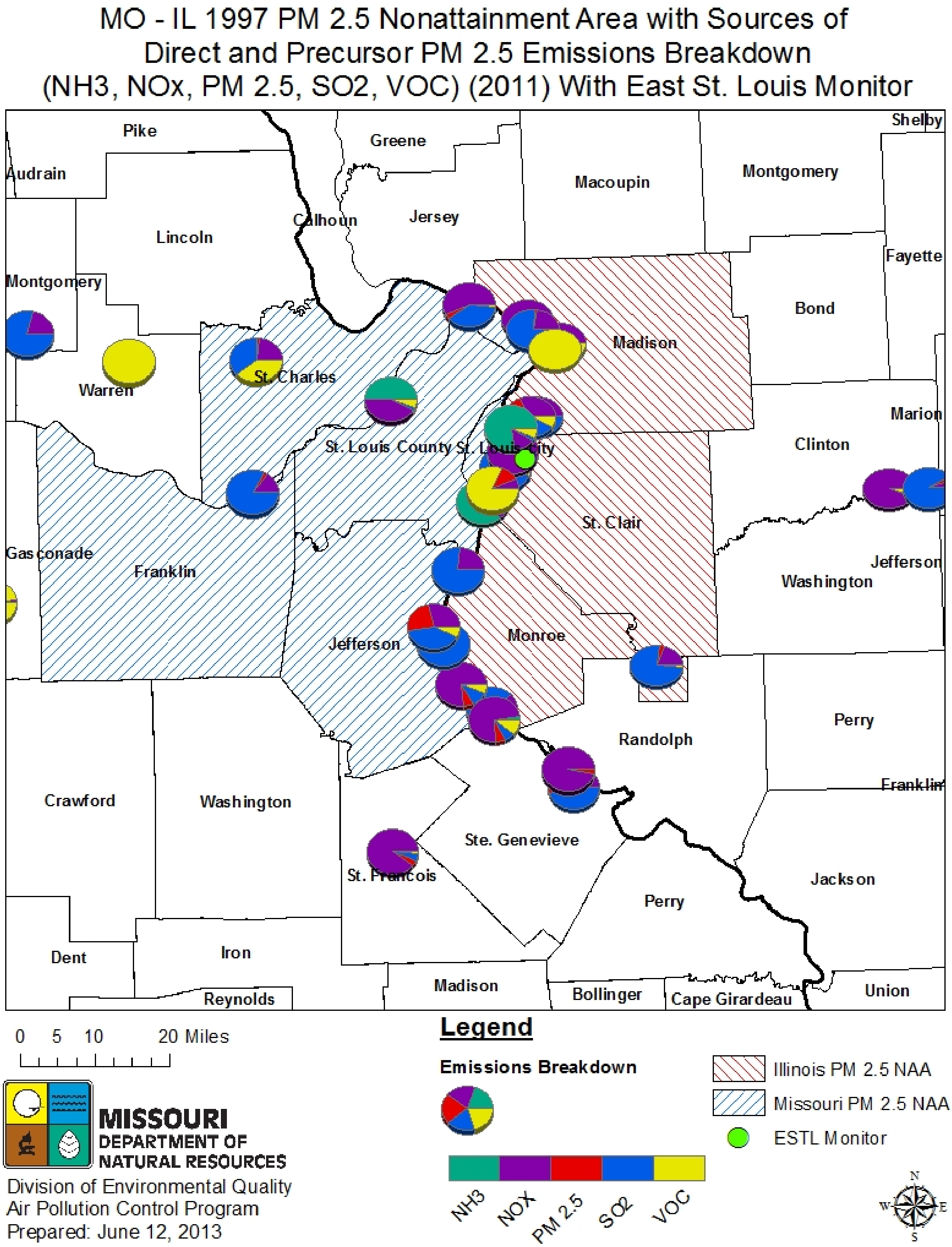

MO - IL 1997 PM 2.5 Nonattainment Area with Sources of
Direct and Precursor PM 2.5 Emissions Breakdown
(NH3, NOx, PM 2.5, SO2, VOC) (2011) With East St. Louis Monitor
Pike
Greene
Shelby
Audrain
Macoupin
Montgomery
Calhoun
Jersey
Lincoln
Fayette
Montgomery
Bond
Madison
St. Charles
Warren
Marion
Clinton
St. Louis County
St. Louis City
St. Clair
Gasconade
Franklin
Jefferson
Washington
Jefferson
Monroe
Perry
Randolph
Franklin
Crawford
Washington
Ste. Genevieve
St. Francois
Jackson
Perry
Dent
Iron
Reynolds
Madison
Bollinger
Cape Girardeau
Union
0 5 10 20 Miles
Legend
Emissions Breakdown
NH3
NOX
PM 2.5
SO2
VOC
Illinois PM 2.5 NAA
Missouri PM 2.5 NAA
ESTL Monitor
MISSOURI
DEPARTMENT OF
NATURAL RESOURCES
Division of Environmental Quality
Air Pollution Control Program
Prepared: June 12, 2013

Table 9 **2011 Facility Level $PM_{2.5}$ and $PM_{2.5}$ Precursor Emissions (tons/year) from Significant Point Sources in the St. Louis Area (Sources with 100 + annual tons of emissions of Direct $PM_{2.5}$ or any Individual $PM_{2.5}$ Precursor) ***

Missouri Facilities

Figure 2 Map Number	County Name	Facility Name	NH_3	NO_X	PM_{25}-PRI	SO_2	VOC	Distance to East St. Louis Monitor (mi.)
1	Pike	ASHLAND INC-MISSOURI CHEMICAL WORKS	2.68	295.33	7.67	1,835.56	58.76	73.38
			0.19%	0.65%	0.14%	0.81%	0.62%	
2	Pike	DYNO NOBEL INC-LOMO PLANT	20.59	462.41	52.99	0.02	0.16	73.35
			1.45%	1.02%	0.98%	0.00%	0.00%	
3	St. Charles	AMEREN MISSOURI-SIOUX PLANT	0.8	7,073.99	413.53	4,899.10	156.51	22.03
			0.06%	15.54%	7.62%	2.16%	1.66%	
4	Montgomery	CHRISTY MINERALS, LLC-HIGH HILL	-	147.7	0.1	549.5	-	68.82
			-	0.32%	0.00%	0.24%	-	
5	Warren	CASCADES PLASTICS INC-WARRENTON	-	-	-	-	163.27	54.76
			-	-	-	-	1.73%	
6	St. Charles	GENERAL MOTORS LLC-WENTZVILLE CENTER	0.31	270.5	26.16	424.24	480.06	38.45
			0.02%	0.59%	0.48%	0.19%	5.08%	
7	St. Louis	MSD, MISSOURI RIVER WWTP-MO RIVER WASTERWATER TREATMENT PLANT	103.16	89.32	0.27	3.66	11.12	19.81
			7.29%	0.20%	0.00%	0.00%	0.12%	
8	St. Louis city	METROPOLITAN ST. LOUIS SEWER DISTRICT-BISSELL POINT WWTP	476.95	80.58	3.44	15.47	40.2	4.64
			33.70%	0.18%	0.06%	0.01%	0.43%	
9	St. Louis city	HERTZ ST. LOUIS ONE, LLC-LACLEDE GAS BUILDING	-	197.05	1.68	0.05	2.57	2.06
			-	0.43%	0.03%	0.00%	0.03%	
10	St. Louis city	ANHEUSER-BUSCH INC-ST. LOUIS	31.8	467.42	158.07	2,998.41	215.07	2.99
			2.25%	1.03%	2.91%	1.32%	2.27%	
11	Franklin	AMEREN MISSOURI-LABADIE PLANT	3.04	9,891.46	1,712.14	57,948.81	323.15	36.80
			0.21%	21.73%	31.53%	25.51%	3.42%	
12	St. Louis city	JW ALUMINUM-ST. LOUIS	-	21.63	36.66	0.16	275.68	5.95
			0.00%	0.05%	0.68%	0.00%	2.92%	
13	St. Louis	METROPOLITAN ST. LOUIS SEWER DISTRICT-LEMAY WWTP	467.9	44.39	1.6	1.78	16.11	8.11
			33.06%	0.10%	0.03%	0.00%	0.17%	
14	St. Louis	AMEREN MISSOURI-MERAMEC PLANT	1.13	4,789.24	171.93	15,281.50	105.65	17.33
			0.08%	10.52%	3.17%	6.73%	1.12%	
15	Gasconade	RR DONNELLEY - OWENSVILLE-OWENSVILLE	0.06	1.84	0.14	0.01	122.75	74.04
			0.00%	0.00%	0.00%	0.00%	1.30%	
16	Jefferson	SAINT-GOBAIN CONTAINERS INC-PEVELY	-	107.22	87.02	149.07	26.35	25.51
			-	0.24%	1.60%	0.07%	0.28%	

Missouri Facilities continued…								
Figure 2 Map Number	County Name	Facility Name	NH_3	NO_X	PM_{25}-PRI	SO_2	VOC	Distance to East St. Louis Monitor (mi.)
17	Jefferson	DOE RUN COMPANY-HERCULANEUM SMELTER	0.29	9.6	4.35	15,234.49	1.71	26.94
			0.02%	0.02%	0.08%	6.71%	0.02%	
18	Jefferson	RIVER CEMENT CO. DBA BUZZI UNICEM USA-SELMA PLANT	5.85	2,029.21	168.35	282.62	151.57	31.28
			0.41%	4.46%	3.10%	0.12%	1.60%	
19	Jefferson	AMEREN MISSOURI-RUSH ISLAND PLANT	1.4	3,441.72	246.31	28,035.57	149.11	33.68
			0.10%	7.56%	4.54%	12.34%	1.58%	
20	Ste. Genevieve	HOLCIM (US) INC-STE. GENEVIEVE PLANT	54.27	1,975.59	194.9	170.63	279.9	35.05
			3.83%	4.34%	3.59%	0.08%	2.96%	
21	Ste. Genevieve	LHOIST NORTH AMERICA OF MISSOURI-STE. GENEVIEVE	-	1,262.89	36.64	9.98	7.77	41.81
			-	2.77%	0.67%	0.00%	0.08%	
22	Ste. Genevieve	MISSISSIPPI LIME COMPANY-STE. GENEVIEVE	0.01	3,630.42	576.67	3,536.37	53.79	44.30
			0.00%	7.98%	10.62%	1.56%	0.57%	
23	St. Francois	PIRAMAL GLASS USA INC-PARK HILLS	3.31	363.23	15.88	19.01	6.27	55.37
			0.23%	0.80%	0.29%	0.01%	0.07%	
Illinois Facilities								
Figure 2 Map Number	County Name	Facility Name	NH_3	NO_X	PM_{25}-PRI	SO_2	VOC	Distance to East St. Louis Monitor (mi.)
24	Madison	Alton Steel Inc.	0.71	131.94	9.14	45.9	3.99	18.74
			0.05%	0.29%	0.17%	0.02%	0.04%	
25	Madison	Dynegy Midwest Generation Inc.	0.62	2,490.76	172.51	8,556.18	60.26	17.45
			0.04%	5.47%	3.18%	3.77%	0.64%	
26	Madison	ConocoPhillips Co	0.17	2,909.80	209.09	1,814.49	1,844.48	16.27
			0.01%	6.39%	3.85%	0.80%	19.51%	
27	Madison	Explorer Pipeline Co	-	-	-	-	120.96	15.2
			-	-	-	-	1.28%	
28	Madison	Gateway Energy & Coke Co LLC	-	406.73	69.46	1,201.41	10.57	5.99
			-	0.89%	1.28%	0.53%	0.11%	
29	Madison	US Steel Granite City	9.07	1,188.86	747.65	1,430.43	293.06	5.72
			0.64%	2.61%	13.77%	0.63%	3.10%	
30	Clinton	Natural Gas Pipeline Co of America	0.09	2,989.76	35.72	0.45	170.05	48.78
			0.01%	6.57%	0.66%	0.00%	1.80%	
31	Clinton	W G Murray Development Center	-	22.79	11.54	355.47	0.16	54.07
			-	0.05%	0.21%	0.16%	0.00%	
32	Randolph	Dynegy Midwest Generation Inc.	128.84	4,771.57	941.17	19,066.03	353.63	32.62
			9.10%	10.48%	17.33%	8.39%	3.74%	

* Note: The percentages listed above indicate each source's percentage of the total 2011 point source emissions in the IL/MO St. Louis MSA for the applicable pollutant.

3.3 Local Emissions Sources in East St. Louis, Illinois

As seen from the Table 9 and Figures 2 and 3, no individual sources of direct $PM_{2.5}$ or $PM_{2.5}$ precursors located in St. Clair County Illinois emitted more than 100 tons of direct $PM_{2.5}$ or $PM_{2.5}$ precursor. However, there are local sources in the area that are potentially contributing to the $PM_{2.5}$ concentration levels recorded by the East St. Louis monitor. Figure 4 displays a satellite image of the area surrounding the East St. Louis monitor in Illinois and labels the location of sources with 10 or more tons/year of total $PM_{2.5}$ and $PM_{2.5}$ precursor emissions in 2011 that could be contributing to the $PM_{2.5}$ concentration levels in the area. Table 11 lists the 2011 emissions for each $PM_{2.5}$ pollutant category for each of the facilities identified in Figure 4 along with the distance between each source and the East St. Louis monitor. As can be seen in the figure, there is a cluster of industrial emissions sources within 1 – 2 miles southwest of the monitor and two rail yards and an airport to the southwest. The figure also displays the rail lines in the area and the I-70 and I-64 highways, with the major intersection of these highways labeled about 0.5 miles to the northwest of the monitor. As seen, in the figure the rail lines spider web around the area, also contributing to $PM_{2.5}$ and $PM_{2.5}$ precursor emissions in close proximity to this monitor. Because of this conglomerate of emissions sources in close proximity of the East St. Louis monitor, it is possible that these sources are contributing to the elevated $PM_{2.5}$ concentrations recorded by the East St. Louis monitor. These sources and their locations must be considered along with meteorological data in order to further analyze the causes and contributions to the violation at this monitor.

Figure 4 Satellite Image of the East St. Louis Monitor with Local Emissions Sources

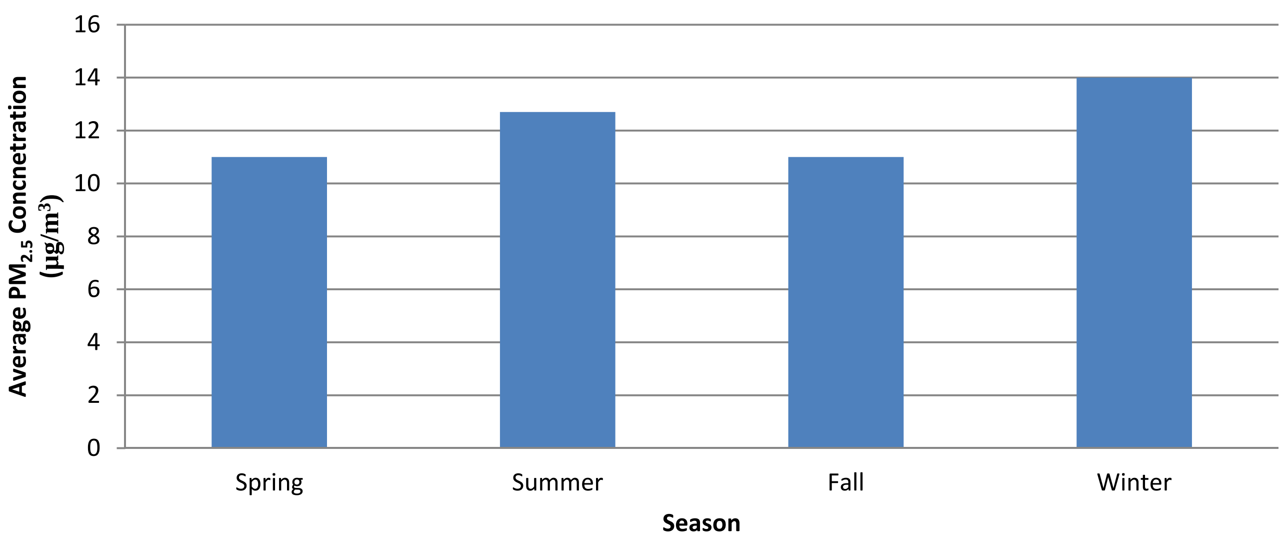
Table 10	East St. Louis Local $PM_{2.5}$/$PM_{2.5}$ Precursor Emissions Sources (2011 Emissions) (tons/year)						
County Name	Facility Name	NH_3	NO_X	$PM_{2.5}$-PRI	SO_2	VOC	**Distance to East St. Louis Monitor (mi.)**
St. Clair	Afton Chemical Corp	3.13	27.36	4.00	92.45	52.31	0.81
St. Clair	Center Ethanol Co	1.47	49.45	15.39	0.94	36.16	1.38
St. Clair	Cerro Flow Products LLC	0.09	3.27	0.46	0.02	23.26	1.53
St. Clair	Coapman Yard	0.01	18.49	0.56	0.16	1.40	1.97
St. Clair	Conoco Phillips Pipe Line Co	-	14.26	-	-	64.34	2.55
St. Clair	East St. Louis Yard	0.02	45.42	1.22	0.37	3.07	1.14
St. Clair	Jet Aviation St Louis Inc.	-	-	-	-	49.09	2.44
St. Clair	Joint American Bottoms & Sauget Treatment Facility	0.01	0.14	0.01	0.00	43.81	2.01
St. Clair	Metro East Industries Inc.	-	-	0.03	-	29.72	1.90
St. Clair	Nuplex Resins LLC	-	-	-	-	18.36	1.66
St. Clair	Resource Recovery Group	0.00	0.14	0.01	0.23	12.14	1.59
St. Clair	Solutia Inc.	0.07	2.73	5.65	0.79	19.25	1.11
St. Clair	St Louis Downtown Airport		4.70	5.18	0.94	8.39	2.87
St. Clair	Veolia ES Technical Solutions LLC	0.02	58.17	1.11	0.49	0.27	1.81

4. Meteorology Data

4.1 Seasonal Variation

In an effort to more fully understand the impacts that meteorology has on $PM_{2.5}$ concentrations at this site, the Air Program analyzed the seasonal average $PM_{2.5}$ concentrations at the East St. Louis monitor from 2010 – 2012. For the purposes of this analysis, the months of December – February were considered winter months, the months of March – May were considered spring months, the months of June – August were considered summer months, and the months of September – November were considered fall months. Figure 5 displays the average seasonal $PM_{2.5}$ concentrations at the East St. Louis monitor from 2010 – 2012. As can be seen, during the winter months $PM_{2.5}$ concentrations averaged 14 $\mu g/m^3$, during the summer months $PM_{2.5}$ concentrations averaged 12.7 $\mu g/m^3$ and during the spring and fall months the $PM_{2.5}$ concentrations averaged just 11.3 $\mu g/m^3$. Therefore, winter meteorological conditions are most conducive to higher $PM_{2.5}$ concentrations, summer conditions are slightly more conducive to higher $PM_{2.5}$ concentrations, and spring and fall conditions are generally the least conducive to high $PM_{2.5}$ concentrations. Because all seasons still produce average $PM_{2.5}$ concentrations near the level of the NAAQS, a full year's worth of data must be taken into account when evaluating the $PM_{2.5}$ levels recorded by this monitor.

Figure 5 East St. Louis Average $PM_{2.5}$ Concentrations by Season (2010 - 2012)



4.2 Wind Rose Data

The next step in the evaluation was to determine the emission source origins on days with high and low $PM_{2.5}$ concentrations at the East St. Louis monitor. For each date in Table 1, hourly wind speed and direction data was gathered from the International Airport Weather Station at the St. Louis Regional Airport in Cahokia, IL. Figure 6 displays the wind rose for all of the hours in the days where the East St. Louis monitor recorded its highest 20 percent $PM_{2.5}$ concentrations during the years 2010 – 2012. As seen in Figure 6, calms represent 40% of the hours during the high days at the East St. Louis monitor for the years evaluated. These calm winds indicate that emissions from local sources are not dissipating from the area and could be significantly impacting the monitored $PM_{2.5}$ concentrations in the area. As stated in subsection 3.3, there are numerous local sources of $PM_{2.5}$ and $PM_{2.5}$ precursors in St. Clair County located nearby this monitor to the southwest, and southeast that could be contributing to the violation, particularly during calm wind events, when local emissions cannot disperse from the area. The second most predominant wind direction associated with high $PM_{2.5}$ days at the East St. Louis monitor are when winds are blowing out of the southeast, which indicates that Missouri sources would not be contributing during these hours on the high days evaluated. However, roughly 10% of the hours in which high $PM_{2.5}$ days were recorded at the East St. Louis monitor were associated with winds blowing out of the northwest quadrant, which could indicate that emissions from Missouri sources are contributing to elevated concentrations during some of the hours on the high $PM_{2.5}$ concentration days.

In an effort to further understand the cause of elevated concentrations at the East St. Louis monitor, the wind directions were also evaluated on days where East St. Louis recorded its lowest $PM_{2.5}$ concentrations. Figure 7 displays the wind rose for all of the hours in the days where the East St. Louis monitor recorded its lowest 20 percent $PM_{2.5}$ concentrations during the years 2010 – 2012. As seen in Figure 7, calms only represented 16% of the hours during these days, which would support a conclusion that higher winds are blowing local emissions out of the area on many of the low $PM_{2.5}$ concentration days, meaning that local sources in the area could be contributing to the violation. During the hours evaluated for the low $PM_{2.5}$ days at the East St. Louis monitor winds were predominantly blowing from the north and northwest quadrants at higher wind speeds. However, winds blowing from the southeast quadrant also make up a sizeable portion of the hours during the low $PM_{2.5}$ days evaluated. The fact that there is no single wind direction that is associated with high or low $PM_{2.5}$ days at this monitor makes it difficult to determine the source(s) that are contributing to the violation at this monitor.

When considering the data from both Figures 6 and 7 together the only consistent trend is that calm and low wind speed events trigger higher concentrations and higher wind events trigger lower concentrations, which supports a conclusion that local emissions sources could be causing the elevated $PM_{2.5}$ concentrations on a significant portion of the high $PM_{2.5}$ episode days. However, understanding that both high concentration days and low concentration days are associated with southeast and northwest winds, it is difficult to draw a conclusion about the sources responsible for the violation. Considering both wind speeds and wind directions, the data is inconclusive as to whether the elevated $PM_{2.5}$ concentrations recorded at this monitor are the result of regional level emissions across the St. Louis area, or if the concentrations are being significantly impacted by the numerous local sources in St. Clair County surrounding the monitor. The potential for local source contribution is discussed in greater detail in Section 5 through a comparison of 24-hour $PM_{2.5}$ concentrations at East St. Louis and Blair Street on the high $PM_{2.5}$ episode days. Finally, as described in subsection 2.3 the East St. Louis monitor only samples $PM_{2.5}$ concentrations every 6th day, which limits the data set that can be used for analysis, contributing greater uncertainty to any conclusion that might be drawn from the wind rose data.

Figure 6 Wind Directions for All Hours of the Day on High $PM_{2.5}$ Concentration Days at East St. Louis in 2010 – 2012

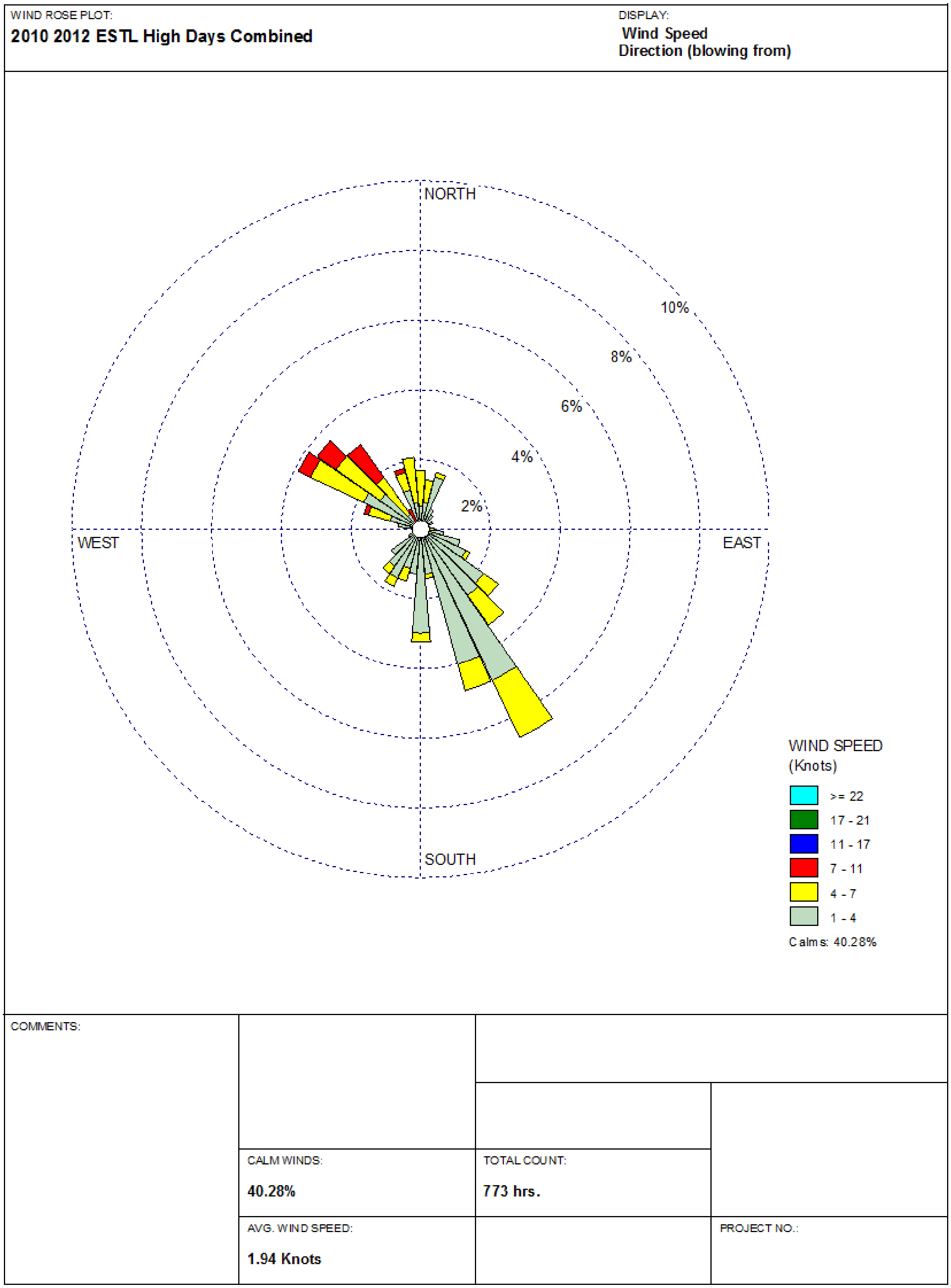
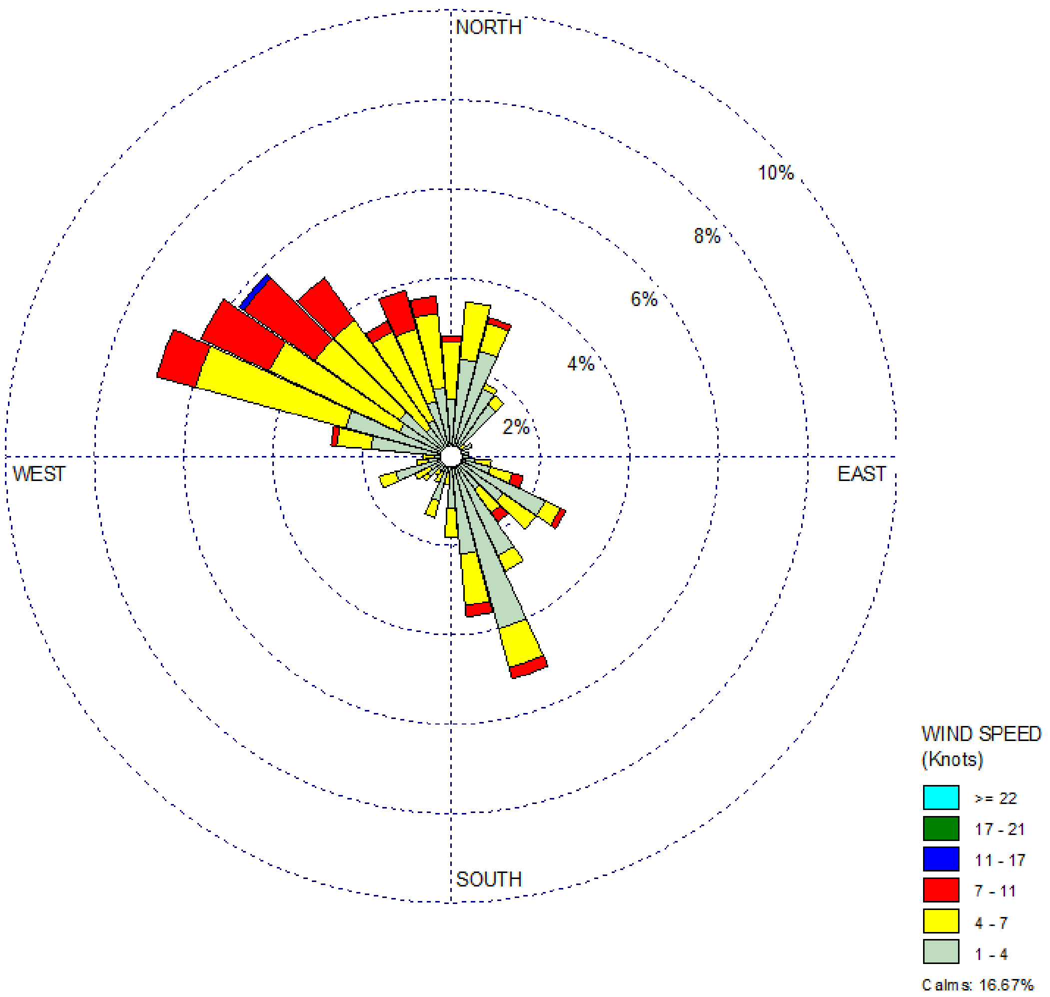


Figure 7 Wind Directions for All Hours of the Day on Low $PM_{2.5}$ Concentration Days at East St. Louis in 2010 – 2012

WIND ROSE PLOT:
2010 2012 ESTL Low Days Combined

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:

CALM WINDS:
16.67%

TOTAL COUNT:
776 hrs.

AVG. WIND SPEED:
3.34 Knots

PROJECT NO.:

4.2 HYSPLIT Modeling

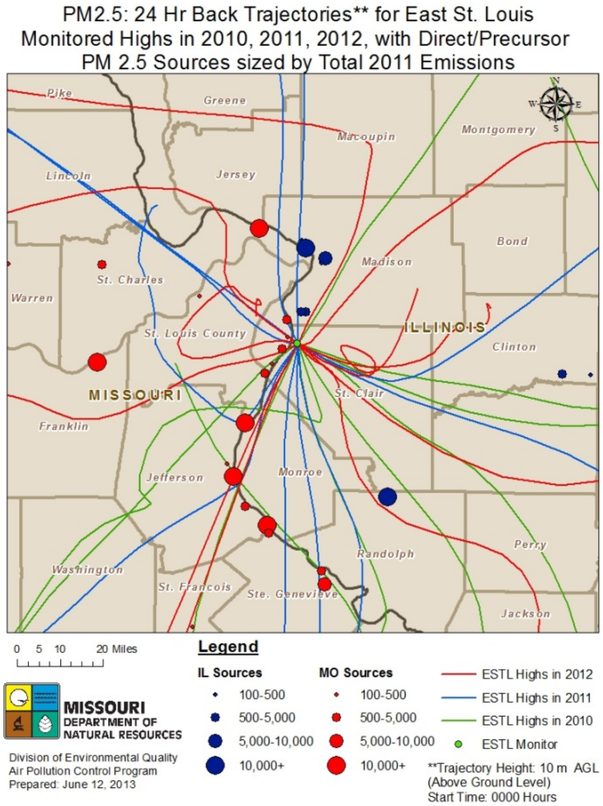
The Air Program also evaluated 24-hour back trajectories of the air masses on both the high days and low days recorded at the East St. Louis monitor from 2010 – 2012. In order to perform this analysis, the back trajectories were generated with the Hybrid Single Particle Lagrangian Integrated Trajectory Model (HYSPLIT). This model is capable of back casting the path that an air mass traveled through prior to arriving at a specific location at a specific point in time. HYSPLIT was used to generate the paths that the air masses came from at the beginning, middle, and end of each day listed in Table 1. It is important to note, that HYSPLIT generates the wind trajectory for a parcel of air at a specific location for one specific point in time. By using HYSPLIT to generate the back trajectories for these three times of the day and considering them all together, it can help determine how air masses were moving over the region during the episode days evaluated. However, because the $PM_{2.5}$ concentrations evaluated are based on a 24-hour average, back casting the wind trajectories from these three specific points in time during the episode days does not necessarily capture the specific path that the air mass traveled prior to the specific point in time of each day when $PM_{2.5}$ concentrations were at their peak.

Figures 8 and 9 give the back trajectories at 12:00 in the morning, 12:00 noon, and 11:00 p.m. for each of the high $PM_{2.5}$ and low $PM_{2.5}$ days respectively, as listed in Table 1. These figures also display the largest point sources located in the Illinois/Missouri MSA along with the location of the East St. Louis Monitor for reference. As seen in Figure 6, from 2010 – 2012 there is no trend indicating typical paths that air masses travel before arriving in East St. Louis on high $PM_{2.5}$ concentration days. According to the HYSPLIT evaluations air masses travel from virtually all directions on some percentage of the high $PM_{2.5}$ days evaluated. Looking at the low-$PM_{2.5}$ concentration days tells a similar story. The most predominant trend on low $PM_{2.5}$ concentration days appears to be when air masses are traveling from the northwest; however, just as with the high $PM_{2.5}$ concentration days air masses travel from all directions on at least a few of the low $PM_{2.5}$ days evaluated. Therefore it is difficult to draw conclusions about the sources that causing the peak $PM_{2.5}$ episodes at this monitor, because there are not any distinct trends that can be used to draw conclusions about the sources that are causing or contributing to the violation at this monitor.

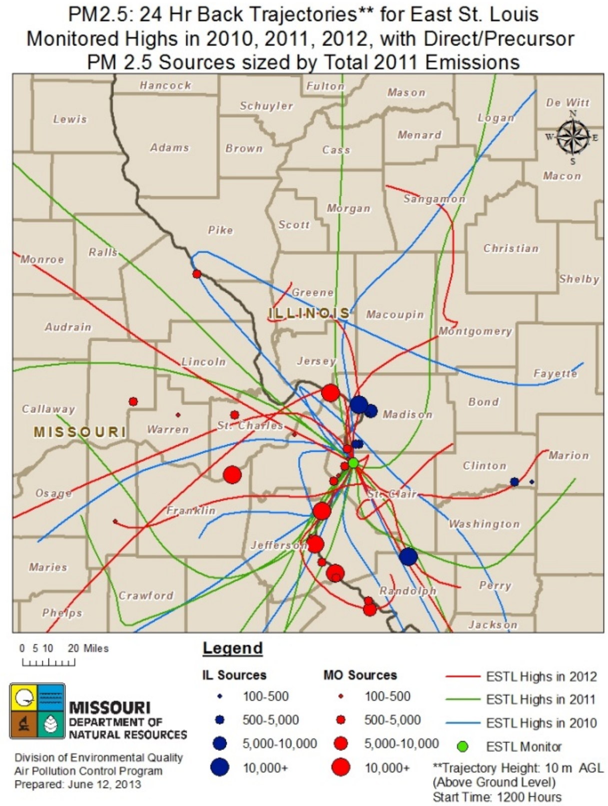
Combining the HYSPLIT, wind rose, and emissions data makes it difficult to draw conclusions about whether the entire urban region is causing the violation, if transported emissions from upwind states are largely responsible, or if the local sources surrounding the East St. Louis monitor are causing the violation. The fact that monitoring data on the Missouri side of the river located in urban core of St. Louis are complying with the NAAQS supports the conclusion that local sources are likely causing the peak $PM_{2.5}$ episodes at the East St. Louis monitor. Additionally, calm and low wind speeds tend to result in more high $PM_{2.5}$ concentrations recorded by the monitor, which also supports the conclusion that local sources are likely causing elevated $PM_{2.5}$ concentrations. However, on some high $PM_{2.5}$ days, air masses are passing over Missouri sources in the St. Louis area, which could support a conclusion that Missouri sources are contributing to elevated $PM_{2.5}$ concentrations on some days. Finally, as stated throughout this analysis, the East St. Louis monitor only samples every 6th day, limiting the amount of data available for analysis, which adds uncertainty, making it difficult to draw conclusions about the contributing sources to this monitor.

Figure 8 HYSPLIT Wind Trajectories for High $PM_{2.5}$ Concentration Days at East St. Louis in 2010 – 2012 (12:00 a.m., 12:00 p.m., and 11:00 p.m.)

12:00 a.m. (Morning)



12:00 p.m. (Noon)



11:00 p.m.

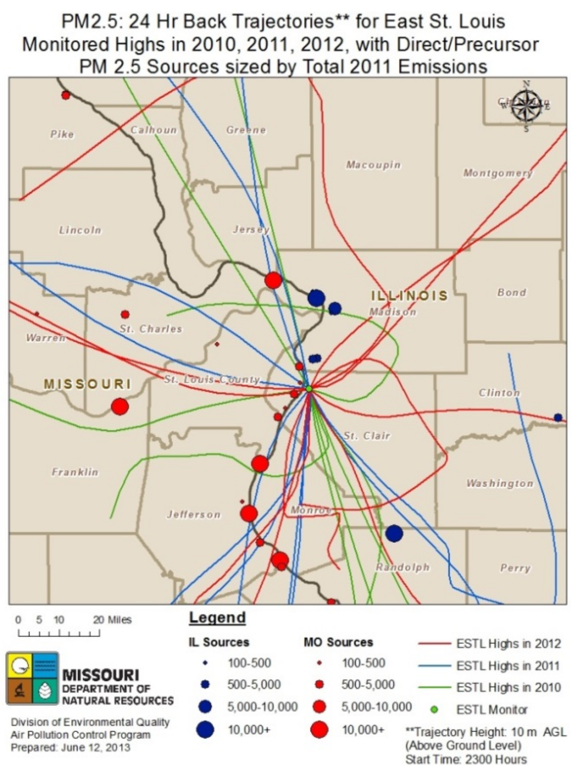
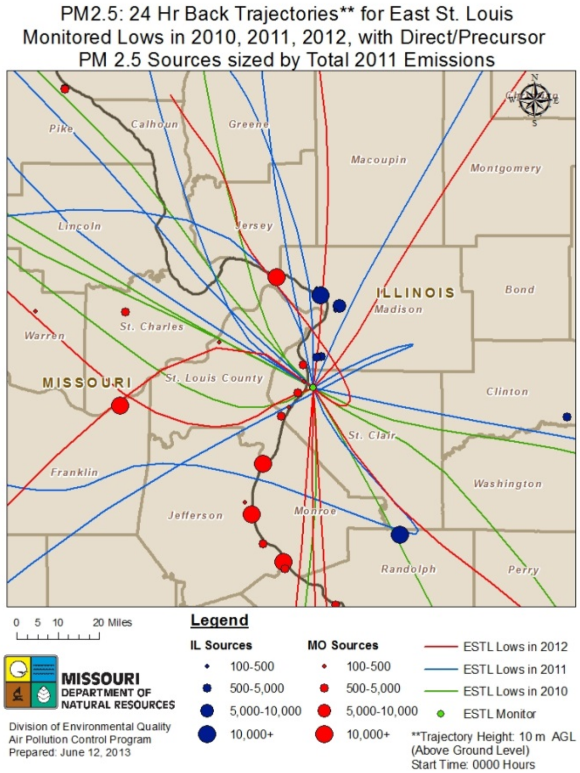
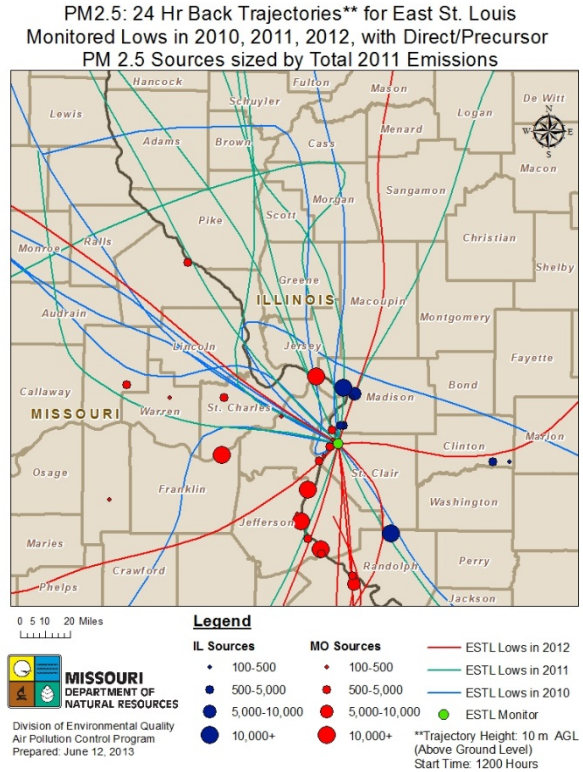


Figure 9 HYSPLIT Wind Trajectories for Low $PM_{2.5}$ Concentration Days at East St. Louis in 2010 – 2012 (12:00 a.m., 12:00 p.m., and 11:00 p.m.)

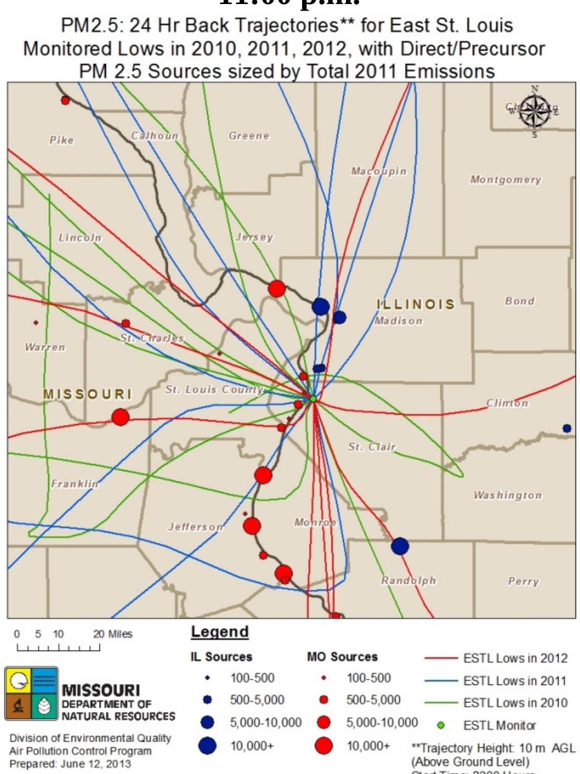
12:00 a.m. (Morning)



12:00 p.m. (Noon)



11:00 p.m.



5. Comparison of $PM_{2.5}$ Concentrations at Blair Street and East St. Louis

5.1 Comparison of 24-hour $PM_{2.5}$ Concentrations

Table 11 displays the distance in miles between each of the St. Louis area monitors included in Figure 1. As seen in the Table, the Blair Street Monitor and the East St. Louis monitor are 3.7 miles apart. It would be expected that due to the proximity of these two monitors, they would monitor very similar $PM_{2.5}$ concentrations from day to day unless immediate local sources of direct $PM_{2.5}$ or $PM_{2.5}$ precursors are impacting one monitor but not the other. It has already been established in Section 4 of this Appendix that calm and low wind speeds are associated with high $PM_{2.5}$ concentrations in East St. Louis, which indicates that local emissions sources could be causing the elevated $PM_{2.5}$ concentrations in the area on some of the high $PM_{2.5}$ episode days.

Depending on wind direction, the Blair Street monitor provides relevant upwind or downwind concentrations that can be used for comparison against the concentrations recorded at the East St. Louis site. The Air Program retrieved the 24-hour $PM_{2.5}$ concentrations at the Blair Street and East St. Louis monitors for the top 20 percent episode days listed in Table 1 and compared these values, which are listed below in Tables 12, 13, and 14 for the years 2010, 2011, and 2012, respectively. As can be seen, the 24-hour values at the highest 20 percent episode days at the East St. Louis are roughly 10% – 15% higher on average than the 24-hour values recorded at the Blair Street site on those same days. However, when looking at the individual days listed in Tables 12 – 14, on most days the values recorded at East St. Louis and Blair Street are very comparable, and Blair Street records higher 24-hour $PM_{2.5}$ on some of the episode days evaluated. The reason the total average 24-hour $PM_{2.5}$ concentration on high $PM_{2.5}$ episode days at East St. Louis is higher than the total average concentration recorded at Blair Street on those same days is because there are several outlier days where the East St. Louis site is recording 24-hour concentrations that are 25% - +100% higher than the concentrations recorded at Blair Street. These outlier days have been highlighted in Tables 12 – 14 and drive the design value at East St. Louis higher than it is across the St. Louis urban core. For this reason, wind rose and HYSPLIT trajectory runs were developed for these specific outlier days in an effort to determine the conditions and sources that might be causing these localized episodes that drive the East St. Louis monitor's design value higher than the monitors located in the St. Louis urban core. Figures 10 and 11 display the wind rose and HYSPLIT results, respectively, for these outlier days at East St. Louis.

As noted in Section 4, the HYSPLIT and wind rose data evaluated indicates that calm and low wind speed events often result in high $PM_{2.5}$ episode days at the East St. Louis monitor; however wind direction and air trajectory paths do not offer specific trends that tend to result in the high $PM_{2.5}$ days recorded at East Louis. The meteorology data analyzed for the outlier days provides similar evidence. Calm wind events comprise 45% of the hours associated with the outlier days, and low wind speeds comprise nearly all of the remaining hours during outlier episodes, but wind directions and trajectory paths do not provide any conclusive trends that can be used to determine the sources that are causing/contributing to the elevated $PM_{2.5}$ concentrations as there is no predominant direction or path that air masses travel from on the outlier days at East St. Louis. The calm and low wind events associated with high and outlier $PM_{2.5}$ days indicate that local emissions could be getting trapped in the area causing elevated levels that are not

experienced even 3.7 miles away at Blair Street. Additionally, the wind direction and trajectory paths that travel across Missouri's portion of the MSA on some of the outlier days, supports the same conclusion that local nearby sources in Illinois could be increasing $PM_{2.5}$ concentrations after the air masses pass through Missouri. The evaluation of the outlier data supports a conclusion that local, nearby sources could be causing the violation at the East St. Louis monitor, but the evaluation does not provide conclusive evidence about the specific sources that are causing/contributing to the violation.

Table 11 Distance Between Monitors in Miles (St. Louis Area $PM_{2.5}$ Monitoring Network)

Site Name:	Arnold West	South Broadway	Blair Street	Branch Street	Ladue	Alton	Wood River	East St. Louis	Granite City
Arnold West	X	9.77	17.97	18.26	14.15	34.26	32.54	17.13	22.54
South Broadway	9.77	X	8.61	8.82	8.79	25.72	23.55	7.36	13.04
Blair Street	17.97	8.61	X	0.47	8.22	17.28	14.95	3.7	4.6
Branch Street	18.26	8.82	0.47	X	8.7	17.21	14.8	3.45	4.28
Ladue	14.15	8.79	8.22	8.7	X	20.73	19.63	10.61	12
Alton	34.26	25.72	17.28	17.21	20.73	X	3.55	20.11	13.7
Wood River	32.54	23.55	14.95	14.8	19.63	3.55	X	17.41	10.93
East St. Louis	17.13	7.36	3.7	3.45	10.61	20.11	17.41	X	6.48
Granite City	22.54	13.04	4.6	4.28	12	13.7	10.93	6.48	X

Table 12 Top 20% Days for E. St. Louis vs. Same Day Value for Blair Street (2010)

Date	E St. Louis 24-Hour value	Blair 24-Hour Value
12/10/2010	23.3	23
12/28/2010	22	22
3/9/2010	21.6	24.1
8/24/2010	20.4	13.7
10/11/2010	19.9	16.5
2/1/2010	19.7	20.2
12/4/2010	19.4	20.3
2/23/2010	19.1	13.7
4/14/2010	18.9	17.3
8/12/2010	18.7	19.1
11/16/2010	17.8	17.4
Average Value for top 20% at ESTL	**20.1**	**18.8**

* Note: All values have been rounded to the nearest 0.1 $\mu g/m^3$

** Note: Outlier days, where the East St. Louis monitor's 24-hour average concentration is at least 25% higher than the concentration recorded at Blair Street

Table 13 Top 20% Days for E. St. Louis vs. Same Day Value for Blair Street (2011)		
Date	E St. Louis 24-Hour value	Blair 24-Hour Value
1/3/2011	37.4	7.1
6/8/2011	25.3	24.9
1/27/2011	24.8	24.5
7/2/2011	22.3	20.2
5/27/2011	21.2	7.6
1/15/2011	20.6	20.4
12/5/2011	20.1	13.2
8/1/2011	19.6	20.7
9/12/2011	18.9	13.2
3/10/2011	18.1	20.8
5/9/2011	18	18.1
Average Value for top 20% at ESTL	**22.4**	**17.3**

* Note: All values have been rounded to the nearest 0.1 µg/m^3

** Note: Outlier days, where the East St. Louis monitor's 24-hour average concentration is at least 25% higher than the concentration recorded at Blair Street

Table 14 Top 20% Days for E. St. Louis vs. Same Day Value for Blair Street (2012)		
Date	E St. Louis 24-Hour value	Blair 24-Hour Value
11/17/2012	32	31.5
1/10/2012	28	22
9/6/2012	20.3	10.1
6/8/2012	16.3	14.9
7/8/2012	16.3	16.6
12/29/2012	16	18.2
1/22/2012	15.9	15.6
3/28/2012	15.7	13.2
8/7/2012	15.2	13
12/17/2012	14.6	16.1
12/23/2012	14.2	14.6
Average Value for top 20% at ESTL	**18.6**	**16.9**

* Note: All values have been rounded to the nearest 0.1 µg/m^3

** Note: Outlier days, where the East St. Louis monitor's 24-hour average concentration is at least 25% higher than the concentration recorded at Blair Street

Figure 10 Wind Directions and Speeds for All Hours of the Day on Outlier $PM_{2.5}$ Concentration Days at East St. Louis in 2010 – 2012

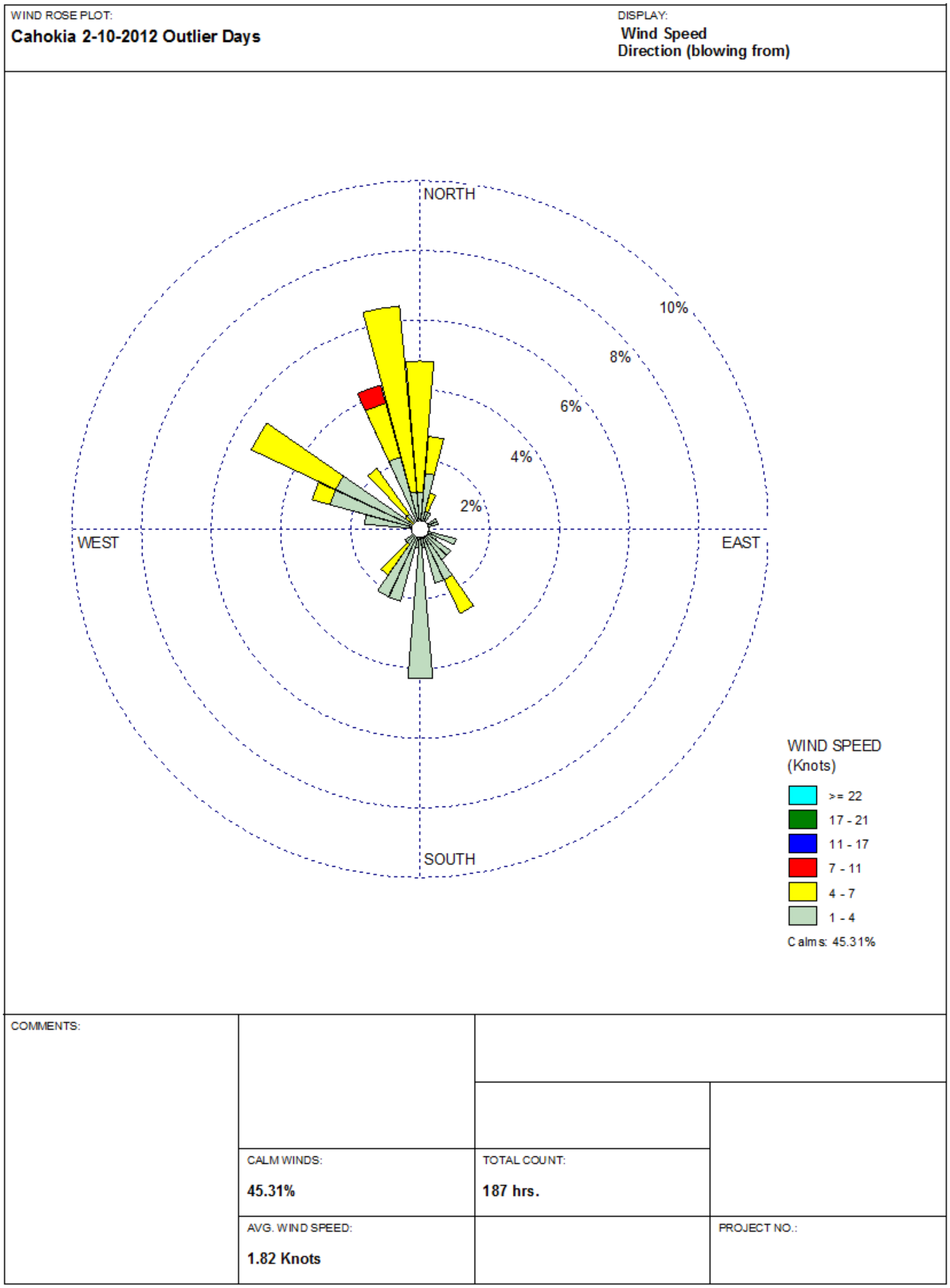
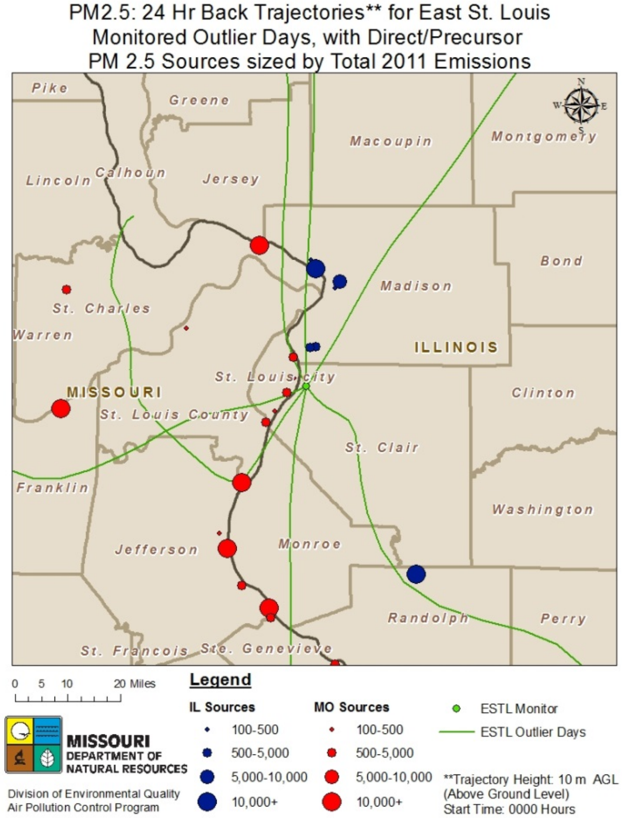
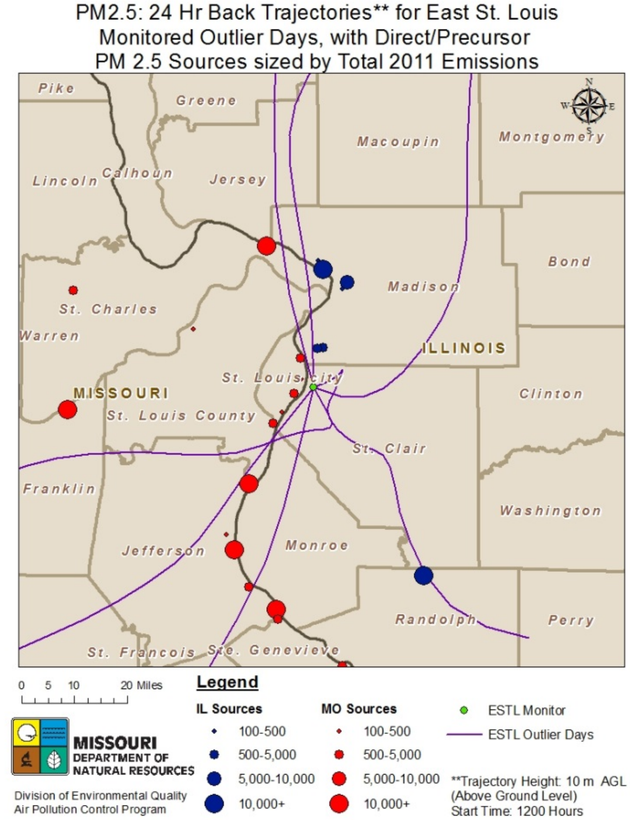


Figure 11 HYSPLIT Wind Trajectories for Outlier $PM_{2.5}$ Concentration Days at East St. Louis in 2010 – 2012 (12:00 a.m., 12:00 p.m., and 11:00 p.m.)

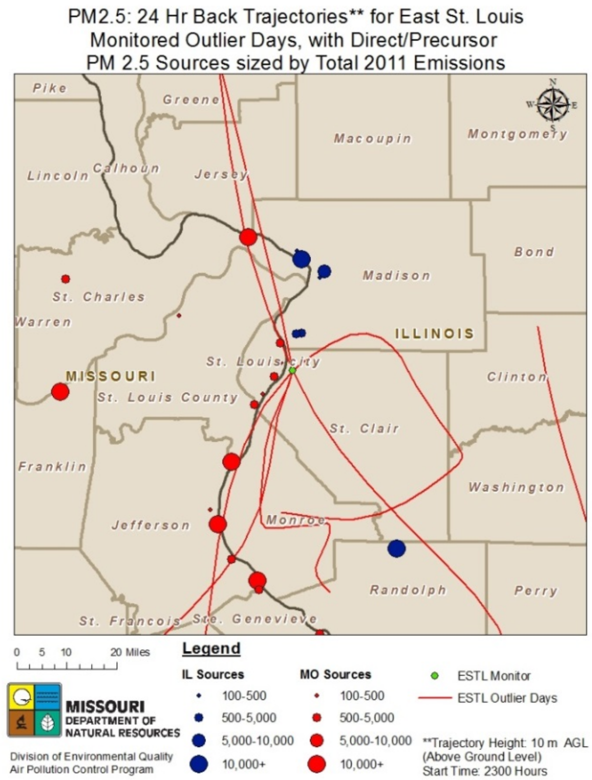
12:00 a.m. (Morning)



12:00 p.m. (Noon)



11:00 p.m.



6. Consideration of Potential Control Strategies for Missouri Sources in the St. Louis Area

It is important to note that the St. Louis area is currently designated nonattainment for the 1997 $PM_{2.5}$ NAAQS. The nonattainment area includes the City of St. Louis and the Counties of Jefferson, St. Louis, St. Charles, and Franklin on the Missouri side, as well as the Township of Baldwin and the Counties of Monroe, St. Clair, and Madison on the Illinois side. The area has obtained clean data based on 2007 – 2009 monitoring data, and Missouri has submitted a maintenance plan and redesignation request for the Missouri side of the nonattainment area to be redesignated to attainment under the 1997 standard. A large bi-state effort between Missouri and Illinois to install controls to reduce emissions of direct $PM_{2.5}$ and $PM_{2.5}$ precursors was performed to meet the Clean Air Act requirements that were triggered when the area was designated nonattainment for the 1997 $PM_{2.5}$ NAAQS. Additionally, many large sources of $PM_{2.5}$ precursor emissions (NO_X and SO_X) have traditionally been controlled through regional emissions programs aimed at reducing background $PM_{2.5}$ concentrations and long-range transport of these emissions, which has also played an important role in reducing annual average $PM_{2.5}$ concentrations across the St. Louis area. Finally, there are numerous federal rules coming into place that will help control $PM_{2.5}$ and $PM_{2.5}$ precursor emissions from some of the largest source categories. This section analyzes the local control measures developed for the 1997 $PM_{2.5}$ NAAQS, the various federal control measures currently being phased in, and the expectation of interstate transport requirements. All of these measures have been compared to Missouri's sources to determine if other additional control measures would be feasible that could produce tangible benefits in terms of $PM_{2.5}$ concentrations in the St. Louis area.

Area sources are difficult to control, and there is uncertainty in the inventory which is largely based on generic emissions calculations. Mobile sources, both on-road and non-road, continue to decline based on federal motor vehicle and non-road engine standards, and this trend is only expected to continue not only in St. Louis but across the country. Furthermore, most states, including Missouri, do not control mobile source emissions through state-specific motor vehicle and non-road engine standards. Most states rely upon federal regulations to control these emissions. Therefore, the only source category that states can typically control through regulations and state implementation plans are permitted point sources. For this reason, much of the analysis in this section compares individual source emissions to total point source emissions in the MO/IL St. Louis MSA.

6.1 Electric Generating Units on the Missouri-Side of the St. Louis Area

Table 15 displays the direct $PM_{2.5}$ and $PM_{2.5}$ precursor emissions in 2011 for the four major electric generating units located on the Missouri side of the St. Louis MSA. These four units are all owned by Ameren and make up a substantial portion of the MSA's point source emissions of direct $PM_{2.5}$, NO_X, and SO_X. Each of these facilities is currently subject to the EPA's Clean Air Interstate Rule (CAIR), which is a regional emission trading program aimed at reducing the $PM_{2.5}$ precursor emissions of NO_X, and SO_2 from electric generating units in the eastern half of the country. It is noted that CAIR has been remanded to EPA; however the courts have directed EPA to continue implementing CAIR until a suitable replacement rule is promulgated. In 2015,

if CAIR has not been replaced, CAIR phase II will begin, which will require further reductions of NO_X and SO_2 emissions from electric generating units that are subject to the rule.

In addition to CAIR, or its expected replacement, the EPA promulgated the Mercury and Air Toxics Standards (Utility MATS) for electric generating units in 2011. Utilities have up to three years to comply with the requirements of this rule with an option for a fourth year if the additional year is necessary for the installation of controls. The Utility MATS requires emissions reductions in mercury and acid gases. It also requires reductions in other hazardous air pollutants, which are measured using $PM_{2.5}$ as a surrogate. Therefore, direct $PM_{2.5}$ emissions are expected to be controlled directly through the Utility MATS rule. Furthermore, while NO_X and SO_2 may not be controlled directly through Utility MATS at EGUs, some control strategies for controlling emissions of acid gases, mercury, and direct $PM_{2.5}$ are expected to have co-benefits for reducing SO_2 and NO_X emissions. It is noted that as part of Ameren's long range planning for environmental compliance, they installed flue-gas desulfurization on their two stacks in their Sioux plant located in St. Charles County in late 2010. This resulted in the reduction of nearly 40,000 tons/year of SO2 emissions, and further demonstrates that these federal rules are resulting in actual significant emissions reductions not only in St. Louis but across the entire country, which is helping to lower the background $PM_{2.5}$ concentrations across the U.S. and in turn the $PM_{2.5}$ concentrations in urbanized areas, such as St. Louis.

Table 15 2011 Missouri EGU Emissions and Percentages in the St. Louis MSA

Facility Name	NH_3	NO_X	PM_{25}-PRI	SO_2	VOC
AMEREN MISSOURI-LABADIE PLANT EMISSIONS (TONS/YEAR)	3.04	9,891.46	1,712.14	57,948.81	323.15
Labadie Percent of Total MSA Point Source Emissions	0.25%	24.65%	38.14%	41.70%	4.35%
Labadie Percent of Total MSA Emissions	0.02%	7.68%	4.97%	41.31%	0.40%
AMEREN MISSOURI-RUSH ISLAND PLANT EMISSIONS (TONS/YEAR)	1.40	3,441.72	246.31	28,035.57	149.11
Rush Island Percent of Total MSA Point Source Emissions	0.11%	8.58%	5.49%	20.17%	2.01%
Rush Island Percent of Total MSA Emissions	0.01%	2.67%	0.72%	19.98%	0.19%
AMEREN MISSOURI-SIOUX PLANT EMISSIONS (TONS/YEAR)	0.80	7,073.99	413.53	4,899.10	156.51
Sioux Percent of Total MSA Point Source Emissions	0.07%	17.63%	9.21%	3.53%	2.11%
Sioux Percent of Total MSA Emissions	0.01%	5.50%	1.20%	3.49%	0.19%
AMEREN MISSOURI-MERAMEC PLANT EMISSIONS (TONS/YEAR)	1.13	4,789.24	171.93	15,281.50	105.65
Meramec Percent of Total MSA Point Source Emissions	0.09%	11.93%	3.83%	11.00%	1.42%
Meramec Percent of Total MSA Emissions	0.01%	3.72%	0.50%	10.89%	0.13%
Combined Missouri EGU Percent of Total MSA Point Source Emissions	0.52%	62.78%	56.67%	76.40%	9.90%
Combined Missouri EGU Percent of Total MSA Emissions	0.05%	19.58%	7.39%	75.67%	0.91%

As seen in Table 15, these four EGUs, which will be controlled through the Utility MATS and either CAIR or its replacement, comprised 62.8%, 56.7%, and 76.4% of total point source NO_X, direct $PM_{2.5}$, and SO_2 emissions respectively for the entire IL/MO St. Louis MSA in 2011. Because these four sources will be controlled through these two federal rules, it is unlikely that controls beyond what will be required by these two rules would be feasible/necessary even if these sources are included in the nonattainment area that will result if the East St. Louis monitor's 2011 – 2013 design value violates the NAAQS.

6.2 Maximum Achievable Control Technology for Industrial/Commercial/Institutional Boilers (Boiler MACT)

On March 21, 2011, EPA promulgated maximum achievable control technology requirements for industrial/commercial/institutional boilers (Boiler MACT) (76 FR 1541). However, implementation of this rule was delayed while EPA reconsidered certain aspects of the rule. The revised rule was released on January 31, 2013 (78 FR 7138). This rule requires existing industrial/commercial/institutional boilers that meet major source threshold requirements to reduce their emissions of acid gases, mercury, dioxin/furans, organic hazardous air pollutants (HAPs), and non-mercury metallic HAPs. While, this rule is intended to control emissions of air toxics, compliance for the limits on the non-mercury metallic HAPs will be determined using filterable $PM_{2.5}$ emissions as the surrogate. Therefore, direct $PM_{2.5}$ emissions will be controlled through this regulation for existing sources subject to the rule. Additionally, the control requirements for acid gases, mercury, dioxin/furans, and organic HAPs will likely have co-benefits for NO_X, SO_X, and VOC emissions for existing sources subject to the rule.

The Air Program has performed preliminary research to determine the existing facilities with boilers that will be subject to this rule. The facilities that are located in the Missouri portion of the St. Louis MSA as well as the facilities located in Missouri counties bordering the St. Louis MSA have been listed below in Table 16. As seen in the table, 23 facilities located in or surrounding the Missouri portion of the St. Louis MSA have a total of 115 emissions units that will be subject to the Boiler MACT, and will be required to comply with the rule beginning January 31, 2016. This is expected to result in further point source emissions reductions of direct $PM_{2.5}$ and $PM_{2.5}$ precursors. In addition, the Boiler MACT established limits for new sources that are more stringent than the requirements for existing sources, ensuring that any industrial/commercial/institutional boilers that are constructed in the future will be well controlled under this federal rule.

Table 16 Missouri Facilities in and Around the St. Louis MSA with Units Subject to the Boiler MACT			
County	**Plant ID**	**Facility Name**	**Number of Boilers Subject to Boiler MACT**
Franklin	0014	CANAM STEEL CORP	1
Franklin	0132	SPORLAN VALVE DIVSION	1
Jefferson	0002	RIVER CEMENT CO. DBA BUZZI UNICEM USA	1
Jefferson	0003	DOE RUN COMPANY	4
Jefferson	0016	Ameren Missouri	4
St. Charles	0001	Ameren Missouri	2
St. Charles	0010	BOEING COMPANY	3
St. Charles	0076	GENERAL MOTORS LLC	9
Ste. Genevieve	0001	MISSISSIPPI LIME COMPANY	13
Ste. Genevieve	0035	CHEMICAL LIME COMPANY	4
St. Louis	0226	GREIF-FENTON	3
St. Louis	0230	BOEING COMPANY	16
St. Louis	0231	CHRYSLER GROUP LLC NORTH PLANT	3
St. Louis	1012	BELT SERVICE CORP	2
St. Louis	1489	GKN AEROSPACE NORTH AMERICA, INC.	3
St. Louis City	0003	ANHEUSER-BUSCH INC	4
St. Louis City	0017	MALLINCKRODT INC	9
St. Louis City	0027	PRECOAT METALS	9
St. Louis City	0040	WASHINGTON UNIV MEDICAL SCHOOL	10
St. Louis City	0697	SIGMA - ALDRICH MFG LLC	7
St. Louis City	1123	U. S. RINGBINDER CORP	2
St. Louis City	1460	ALLIED HEALTH CARE PRODUCTS	1
St. Louis City	2433	NEW WORLD PASTA	4

6.3 Implementation of Reasonably Available Control Technology (RACT) for Missouri Sources Under the 1997 $PM_{2.5}$ NAAQS

As mentioned above, the City of St. Louis and the Counties of St. Louis, St. Charles, Franklin, and Jefferson were included in the MO/IL St. Louis nonattainment areas under the 1997 Annual $PM_{2.5}$ NAAQS. As required by the Clean Air Act and the Implementation Rule for this standard, RACT evaluations were performed for all significant point sources located in the nonattainment area. Implementation of RACT under the 1997 $PM_{2.5}$ NAAQS in the St. Louis area required RACT analyses for all sources on the Missouri side that had direct $PM_{2.5}$ emissions above 10 tons/year and were within 10 miles of the Granite City monitor, as this was the monitor with the highest design value for the area, and was the most difficult monitor for which to demonstrate attainment of the 1997 Annual $PM_{2.5}$ NAAQS. As seen in Table 11, the Granite City monitor is only 6.48 miles from the East St. Louis monitor, and therefore, any reductions in Missouri that impact the Granite City monitor would likely have a similar impact on the East St. Louis monitor. The 10 mile radius around the Granite City monitor for sources of direct $PM_{2.5}$ emissions was selected for the RACT evaluation because direct $PM_{2.5}$ emissions have a very localized impact on $PM_{2.5}$ concentrations and do not have a significant impact on $PM_{2.5}$ concentrations in areas at greater distances downwind. The RACT implementation also included RACT analyses for all point sources with NO_X emissions greater than 50 tons/year and all point sources with SO_2 emissions greater than 25 tons/year.

Through the RACT evaluation several sources in the nonattainment area implemented control strategies that were determined to be RACT. Several sources also demonstrated that the control technologies already in place satisfied RACT because additional controls were either too costly or not feasible. Table 17 provides a list of the sources in St. Louis that were required to perform RACT evaluations under the 1997 $PM_{2.5}$ NAAQS for each of these three pollutants.

Table 17	2011 Missouri Sources Required to Perform a RACT Evaluation Under the 1997 $PM_{2.5}$ NAAQS	
	Direct $PM_{2.5}$ Sources	
County	2008 Facility ID	Facility Name
St. Louis City	510-0156	AMERICAN COMMERCIAL TERMINALS
St. Louis City	510-0040	WASHINGTON UNIVERSITY MEDICAL SCHOOL
St. Louis City	510-0809	PQ CORPORATION
St. Louis City	510-0003	ANHEUSER BUSCH - ST. LOUIS
St. Louis City	510-0072	FEDERAL MOGUL FRICTION PRODUCTION
St. Louis City	510-0053	ST. LOUIS METROPOLITAN SEWER DISTRICT - BISSEL
St. Louis City	510-0057	PROCTOR & GAMBLE
St. Louis City	510-2565	BEELMAN RIVER TERMINALS
St. Louis City	510-0017	MALLINCKRODT INC
	NO_X Sources	
County	2008 Facility ID	Facility Name
Franklin	071-0003	AMERENUE - LABADIE
Jefferson	099-0002	RC CEMENT COMPANY (BUZZI UNICEM)
Jefferson	099-0016	AMERENUE - RUSH ISLAND
Jefferson	099-0068	SAINT - GOBAIN CONTAINERS - PEVELY
St. Charles	183-0001	AMERENUE - SIOUX
St. Charles	183-0076	GENERAL MOTORS - WENTZVILLE
St. Charles	183-0027	MEMC ELECTRONIC MATERIALS
St. Louis City	510-0003	ANHEUSER-BUSCH INC - ST. LOUIS
St. Louis City	510-2378	LACLEDE GAS
St. Louis City	510-0809	PQ CORPORATION
St. Louis City	510-0038	TRIGEN - ASHLEY STREET
St. Louis City	510-0017	MALLINCKRODT INC
St. Louis City	510-0053	ST. LOUIS METROPOLITAN SEWER DISTRICT - BISSEL
St. Louis County	189-0010	AMERENUE - MERAMEC
St. Louis County	189-0230	BOEING COMPANY
St. Louis County	189-0231	CHRYSLER CORP-NORTH PLANT
St. Louis County	189-1205	ST. LOUIS METROPOLITAN SEWER DISTRICT - MO RIVER
St. Louis County	189-1210	ST. LOUIS METROPOLITAN SEWER DISTRICT - COLDWATER
St. Louis County	189-0217	ST. LOUIS METROPOLITAN SEWER DISTRICT - LEMAY
	SO_2 Sources	
County	2008 Facility ID	Facility Name
Franklin	071-0003	AMERENUE - LABADIE
Jefferson	099-0003	DOE RUN COMPANY - HERCULANEUM
Jefferson	099-0016	AMERENUE - RUSH ISLAND
Jefferson	099-0002	RC CEMENT COMPANY (BUZZI UNICEM)
Jefferson	099-0068	SAINT - GOBAIN CONTAINERS - PEVELY
St. Charles	183-0001	AMERENUE - SIOUX
St. Charles	183-0076	GENERAL MOTORS - WENTZVILLE
St. Louis City	510-0003	ANHEUSER-BUSCH INC - ST. LOUIS
St. Louis City	510-0017	MALLINCKRODT INC
St. Louis City	510-0809	PQ CORPORATION
St. Louis City	510-0038	TRIGEN - ASHLEY STREET
St. Louis City	510-0040	WASHINGTON UNIVERSITY MEDICAL SCHOOL
St. Louis City	510-0053	ST. LOUIS METROPOLITAN SEWER DISTRICT - BISSEL
St. Louis County	189-0010	AMERENUE - MERAMEC
St. Louis County	189-0230	BOEING COMPANY

Through the RACT evaluation performed in 2007 - 2009 for the direct $PM_{2.5}$ sources, no additional controls were required. Many of the sources included in the evaluation were already well controlled at levels of 50% control or greater for their $PM_{2.5}$ emissions. Additionally, due to the relatively low direct $PM_{2.5}$ emissions for the sources evaluated in Missouri it was determined that additional direct $PM_{2.5}$ controls at these facilities would not have a significant impact on the monitored $PM_{2.5}$ concentrations on the Illinois side of the St. Louis MSA.

Through the RACT evaluation performed in 2007 - 2009 for the NO_X sources, Washington University switched their coal fired boilers to natural gas. The Boeing company removed their two coal fired boilers. MEMC signed a consent agreement to continue operating their scrubbers to control NO_X from their acid bath/etching process. This consent agreement has since been terminated due to the retirement of the units for which the agreement applied. St. Gobain Containers installed oxy-fuel firing on both of their glass melting furnaces, and Buzzi Unicem (RC Cement) replaced their long wet kilns with a preheater/precalciner configuration, which lowered their permitted NO_X emissions by over 1,600 tons/year.

The non-utility boilers at General Motors, Trigen – Ashley Street Station, and Mallinckrodt had previously undergone a RACT evaluation under the 1997 Ozone NAAQS and are subject to 10 CSR 10-5.510 *Control of Emissions of Nitrogen Oxides*, which was determined to meet RACT requirements for the 1997 $PM_{2.5}$ NAAQS. The four Ameren facilities were determined to meet RACT after an evaluation of the existing controls and NO_X rates at these facilities combined with their requirements under CAIR. All other facilities were able to demonstrate that additional controls would exceed the requirements of RACT due to economic or logistical feasibility reasons.

Through the RACT evaluation performed in 2007 - 2009 for the SO_2 sources, the first group evaluated was non-boiler sources including PQ Corporation, St. Gobain Containers, Buzzi Unicem (RC Cement), the St. Louis Metropolitan Sewer District, and Doe Run – Herculaneum. The following three sources were not required to install additional SO_2 controls as a result of RACT due to high costs of control and their already relatively low SO_2 emissions: PQ Corporation, St. Gobain Containers, and the Metropolitan Sewer district. Buzzi Unicem (RC Cement) was determined to meet RACT requirements through the replacement of their long wet kilns with a state of the art preheater/precalciner configuration as mentioned above, which effectively reduces SO_2 emissions by 95% through the inherent scrubbing of the new system. Doe Run – Herculaneum was required to reduce SO_2 emissions through a tiered approach as required in 10 CSR 10-6.260 *Restriction of Emission of Sulfur Compounds*, in which SO_2 emissions are limited to 25,100 tons/year in 2012, 16,350 tons/year in 2014, and zero (0) tons/year in 2017. A more recent federal consent decree requires this facility to cease operations at their blast furnace and sinter plant by 2014, eliminating the SO_2 emissions from these units three years sooner than the state rule requires.

The second group evaluated for SO_2 controls through this RACT evaluation was the industrial/commercial/institutional boiler sources including Washington University, Boeing Company, Trigen-Ashley Street Station, Anheuser Busch, Mallinckrodt, and General Motors – Wentzville. As noted above, Washington University switched their coal fired units to natural gas, and Boeing removed their two coal-fired units. Both of these control strategies were

determined to meet RACT requirements. For the other companies, the RACT evaluations were performed and SO_X limits were established based on limits achievable through reasonable controls for each of the boilers and these limits were codified into 10 CSR 10-6.260 *Restriction of Emission of Sulfur Compounds*. Since the RACT evaluation, Trigen-Ashley Street station has retired their coal fired boiler units 5 and 6, and Anheuser Busch has retired its coal fired boiler unit 6.

The last group evaluated for SO_2 controls through this RACT evaluation included the four Ameren EGU facilities, which were determined to meet RACT requirements for SO_2 because of their participation in CAIR. The emissions and expected control measures for these four EGU facilities are discussed in greater detail in the subsection above.

These RACT evaluations for NO_X and SO_2 included an evaluation of the point sources in the St. Louis nonattainment area, accounting for 98% of all point source emissions for these pollutants in the area. The RACT evaluation and corresponding control requirements reduced sulfur dioxide (SO_2) and nitrogen oxides (NOx) emissions from Missouri sources by 20,133 tons/year and 1,067 tons/year, respectively after 2011. However, despite these significant reductions in Missouri's emissions inventory, the photochemical model used in Missouri's attainment demonstration for the 1997 Annual $PM_{2.5}$ NAAQS showed through a sensitivity analysis that these reductions would only decrease the annual $PM_{2.5}$ design value at East St. Louis by 0.12 $\mu g/m^3$ in 2012, which supports the conclusion that emissions from Missouri sources do not have a significant impact on the $PM_{2.5}$ concentrations recorded at the East St. Louis monitor.

This RACT evaluation was submitted to EPA in September 2009 as part of the attainment demonstration for the 1997 $PM_{2.5}$ NAAQS, and because the RACT evaluations were performed so recently, it is unlikely that another RACT evaluation would result in any new control requirements for Missouri sources in the area. Furthermore, as a result of federal control measures discussed above, the required shutdown at the Doe Run facility, and the continued decline of mobile source emissions, it's unlikely that further state or local controls would even be necessary to meet reasonable further progress obligations if Missouri is included in the nonattainment area that will result if the East St. Louis monitor violates the 2012 Annual NAAQS based on 2011 – 2013 monitoring data. Therefore, if areas in Missouri are ultimately included in a nonattainment area due to a violation at the East St. Louis monitor, few if any new controls in Missouri, beyond what is already in place or expected in the near future, will actually be required for the area. This means there would be no net air quality benefit by designating areas in Missouri nonattainment based on a violation in East St. Louis, it would only require Missouri to develop a resource intensive attainment demonstration for the area.

7. Conclusion

In conclusion, when considering monitoring data, emissions data, and meteorology of counties surrounding the violating monitor located in East St. Louis, IL it is unclear exactly what is causing the violation at this monitor. Some criteria evaluated through the weight of evidence analysis provide inconclusive evidence about the sources that are causing/contributing to the violation at this monitor, yet other criteria evaluated support the conclusion that nearby local sources in East St. Louis are causing the violation at this monitor. The 2010 – 2012 design values for all monitors that are suitable for comparison to the annual NAAQS on the Missouri side of the St. Louis MSA attain the NAAQS, where the East St. Louis monitor on the Illinois side of the St. Louis MSA is not attaining, which supports a conclusion that local nearby sources could be causing the violation.

Meteorology data supports this same conclusion. High $PM_{2.5}$ episode days are associated with a significant portion of calm wind events, and low days are associated with few calm wind events, supporting the conclusion that local sources are causing the peak episodes; however the trajectory data indicates that air masses traveling from all directions including some days over the path of Missouri sources and some days from other directions which could support a conclusion that the urban region or long range transport is causing/contributing to the violation.

Through the review of emissions data from 2008 and 2011, Missouri sources comprise a large percent of the region's overall emissions inventory. However, $PM_{2.5}$ is a complicated pollutant. There are both direct and indirect $PM_{2.5}$ emissions. Direct emissions contribute significantly to the concentrations to the immediate local area, and indirect emissions depending on the pollutant being analyzed can come from hundreds of miles away before forming particulate at ground-level, or it could condense or form at ground-level in the immediate local area based on meteorological conditions. Therefore it is difficult to draw any conclusion based on emissions data alone.

The review of controls in place in Missouri in the St. Louis area along with the expected future controls that will help control emissions in the area indicates that a nonattainment designation for Missouri likely would not result in any more controls for the area other than the controls that will be required regardless of the ultimate designation for the area.

Through this weight of evidence analysis performed to analyze the $PM_{2.5}$ concentrations at the East St. Louis monitor, the evidence is inconclusive about whether Missouri sources are causing or contributing to the violation at this monitor. It is noted that the fact that the East St. Louis monitor only samples one in six days and there is no CSN speciation data to evaluate also adds to the difficulty in determining sources that are causing/contributing to the violation at this monitor.

Furthermore, as indicated in subsection 2.2 of this Appendix, it is possible that the East St. Louis monitor will come into compliance with the 2012 annual $PM_{2.5}$ NAAQS once 2013 is complete and the design value is based on the more recent 2011 – 2013 time period because of the downward trend in $PM_{2.5}$ concentrations across the entire St. Louis Region over the past decade.

Taking all of the available evidence into consideration, Missouri's recommendation is to designate all areas in Missouri as attainment/unclassifiable if a nonattainment area results

because the 2011 – 2013 design value at the East St. Louis monitor violates the standard. This recommendation is based on all available evidence including ambient air quality data, emissions data, and meteorology data, which through this evaluation are inconclusive when attempting to determine the potential sources that are causing/contributing to the elevated $PM_{2.5}$ concentrations in East St. Louis. This recommendation is also based on the consideration of potential controls that might be required if Missouri areas were designated nonattainment, along with the downward trend in $PM_{2.5}$ concentrations across the entire St. Louis region over the past decade and in recent years. Finally, due to the federal control measures already in place this declining trend in $PM_{2.5}$ concentrations across St. Louis is only expected to continue, which will likely result in the East St. Louis monitor attaining the 2012 Annual NAAQS in the near future, regardless of whether areas in Missouri are ultimately designated attainment or nonattainment.

Missouri
Department of
Natural Resources

Appendix C

Technical Discussion Regarding the Unique Middle Scale Monitor Status of the Branch Street Monitor (AQS Site ID: 29-510-0093)

Introduction

The Branch Street monitor (AQS Site ID: 29-510-0093) is defined as a unique middle scale monitor and has been given a legacy exemption meaning it is not comparable to the 2012 Annual $PM_{2.5}$ NAAQS, per EPA's July 2013 Air Quality Design Value Review: http://www.epa.gov/ttn/analysis/dvreview.htm. This monitor is not representative of area-wide $PM_{2.5}$ concentrations as many of the episodes and trends recorded at the Branch Street monitor are unique to this location and not experienced across the St. Louis Region even by the neighborhood scale Blair Street monitor, which is less than 800 m from the Branch Street monitor location. Therefore, while trends and episodes at this monitor are useful and relevant for comparison and analysis of the 24-hour $PM_{2.5}$ NAAQS, the episodes and design values at this monitor are not suitable for comparison and analysis of the Annual $PM_{2.5}$ NAAQS.

Ever since the Branch Street Monitor was established it has always been classified in Missouri Annual Monitoring network plans as a unique middle scale monitor that is not comparable to the annual $PM_{2.5}$ NAAQS. This Appendix provides background information regarding the establishment of the Branch Street Monitor, along with a technical discussion regarding its unique nature that is not representative of area wide trends and episodes across the St. Louis region, which is the reason it is not suitable for comparison to the annual $PM_{2.5}$ NAAQS.

Branch St. Monitoring Site Background and Technical Discussion

The Branch St. Ambient Air Monitoring site was established October 1, 2006 as a replacement for the former North Market PM_{10} air monitoring site (AQS Site ID: 29-510-0092) which was subsequently discontinued with EPA approval since it no-longer met siting criteria required in 40 CFR Part 58 Appendix E. $PM_{2.5}$ monitoring at Branch St. was initiated July 16, 2007.

Although the Branch St. $PM_{2.5}$ monitor is identified in the 2007 and subsequent Monitoring Network Plans as being a middle-scale monitor not comparable to the annual $PM_{2.5}$ NAAQS due to its proximity to a group of local sources, no additional rationale for identifying the site as comparable to the Annual $PM_{2.5}$ NAAQS is required by 40 CFR Part 58.30. However, more details concerning the purpose of the $PM_{2.5}$ monitoring at Branch St. is available in the departments' 2010 Monitoring Network Assessment (http://dnr.mo.gov/env/apcp/2010monitoringnetworkassessment.pdf).

The 2010 Monitoring Network assessment, Sections 8 and 10, describe rationale for establishing the Branch St. site for particulate matter monitoring. In addition to the Network Assessment, internal staff memoranda during this period indicate that the $PM_{2.5}$ monitoring at Branch St. was also initiated for monitoring of the coarse fraction of PM_{10} ($PM_{10-2.5}$). This size fraction of PM_{10} is often referred to as PMcoarse. In anticipation of EPA promulgating its proposed $PM_{10-2.5}$ standard (71 Federal Register, January 17, 2006, notice of proposed rulemaking), department staff identified the Branch St. site as being one of a small number of locations that would satisfy the proposed monitoring requirement by yielding maximum $PM_{10-2.5}$ concentrations primarily due to the unique middle scale PM_{10} concentrations which had been monitored at the former North Market PM_{10} site.

Despite the fact that the PMcoarse standard was not promulgated by EPA in the October, 17, 2006 monitoring regulation changes (71 Federal Register, October 17, 2006), $PM_{2.5}$ monitoring had already been established at Branch St. and was approved by EPA Region VII in the 2007 Monitoring Network Plan as a State or Local Air Monitoring Site (SLAMS) for 24-hour $PM_{2.5}$ NAAQS compliance. The data from the Branch St. $PM_{2.5}$ monitoring site indicates that no short term (24-hour) violations of the $PM_{2.5}$ NAAQS have been observed despite the high potential for short term direct $PM_{2.5}$ emissions form unique local sources. The Branch St. site is located approximately 750 meters (2,460 ft) to the East of the Blair

St. $PM_{2.5}$ ambient air monitoring site (AQS Site ID: 29-510-0085) (**Figure 1**). The Blair St. $PM_{2.5}$ site is representative of the neighborhood spatial scale of representativeness defined in 40 CFR Part 58 Appendix D and is comparable to both the Annual and 24-hour $PM_{2.5}$ NAAQS.

Recent continuous $PM_{2.5}$ Federal Equivalent Method (FEM) monitoring initiated at Branch St. indicates a significant diurnal trend in $PM_{2.5}$ concentrations that are unique to the Branch St. monitor and appear to be coincident with a single shift operational schedule that has a traditional lunch hour. **Figure 2** compares and contrasts this unique diurnal trend with other area wide ambient air monitoring sites in the St. Louis area. Finally, **Figure 3** depicts the conditional probability plot (pollution rose) of hourly $PM_{2.5}$ concentration data plotted by sector of wind rose using on-site 10 meter wind direction meteorological data for both the Branch St. and Blair St. $PM_{2.5}$ monitors. If the Branch St. monitor were representative of area wide $PM_{2.5}$ concentrations, both the Blair St. and Branch St. $PM_{2.5}$ pollution roses would look similar. Clearly the Branch St. monitor observes peak $PM_{2.5}$ concentrations on average from the north and south east sectors in magnitudes that are not observed at Blair St.

The previous technical data and current lack of annual $PM_{2.5}$ NAAQS violations at the Blair St. site indicates that the annual $PM_{2.5}$ concentrations monitored at Branch St. are not area wide and, consistent with 40 CFR Part 58.30, are not comparable to the annual $PM_{2.5}$ NAAQS.

Figure 1

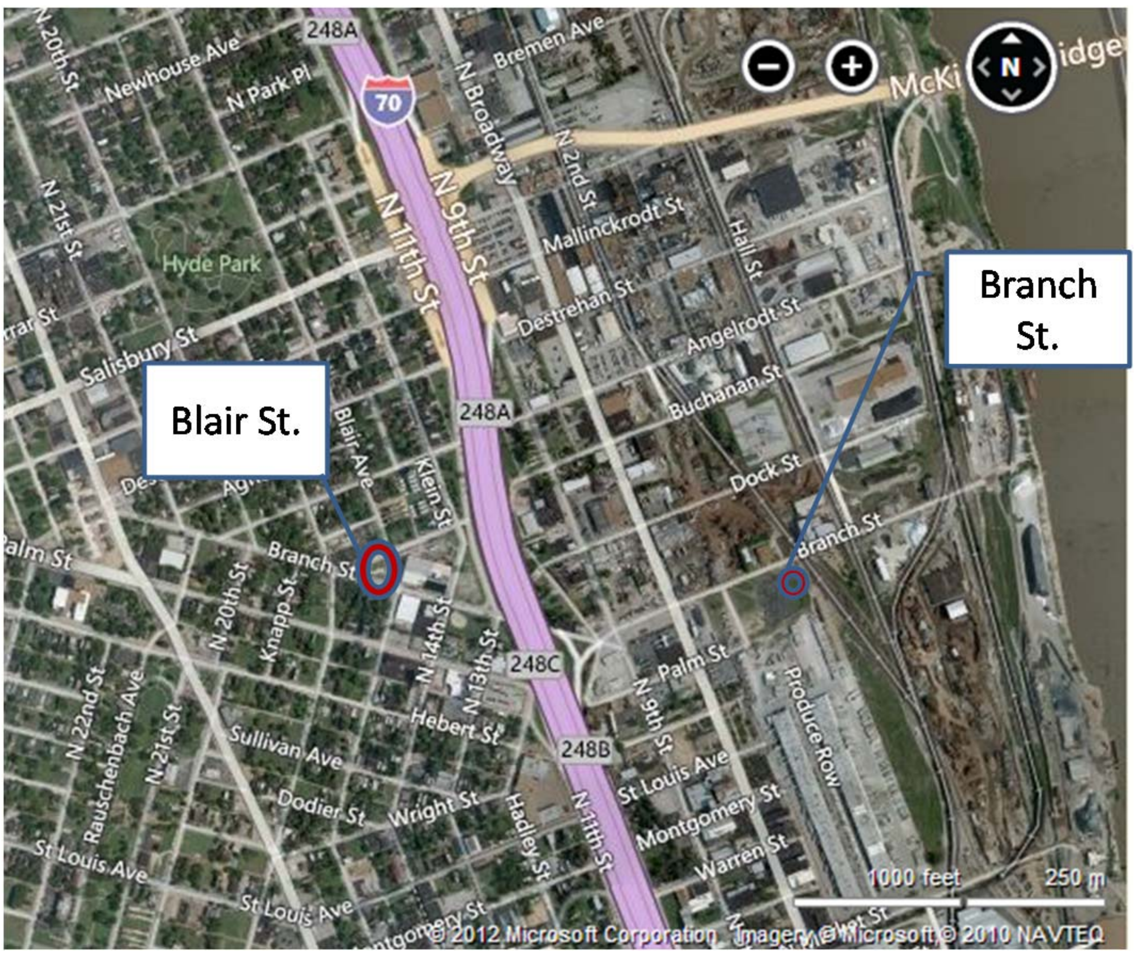


Figure 2

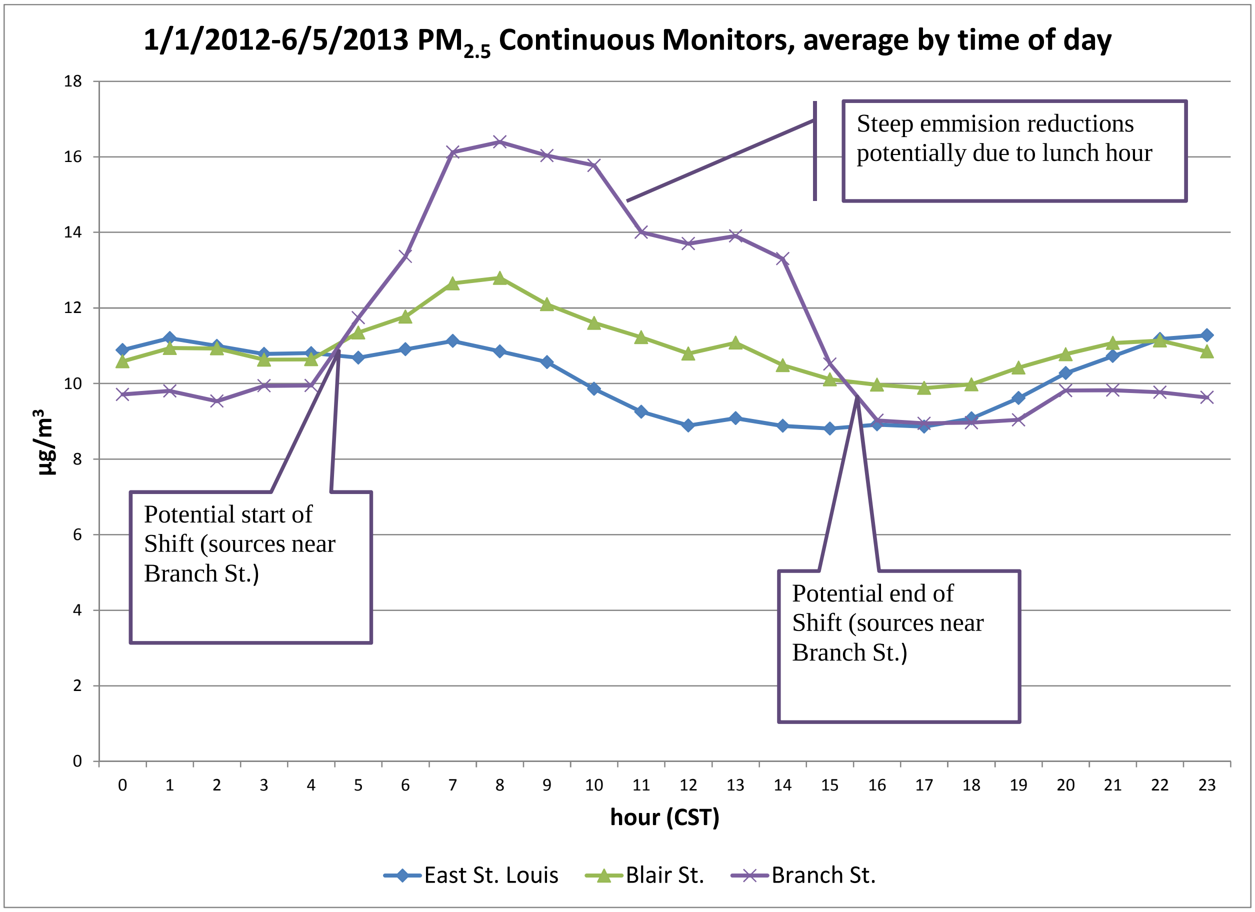
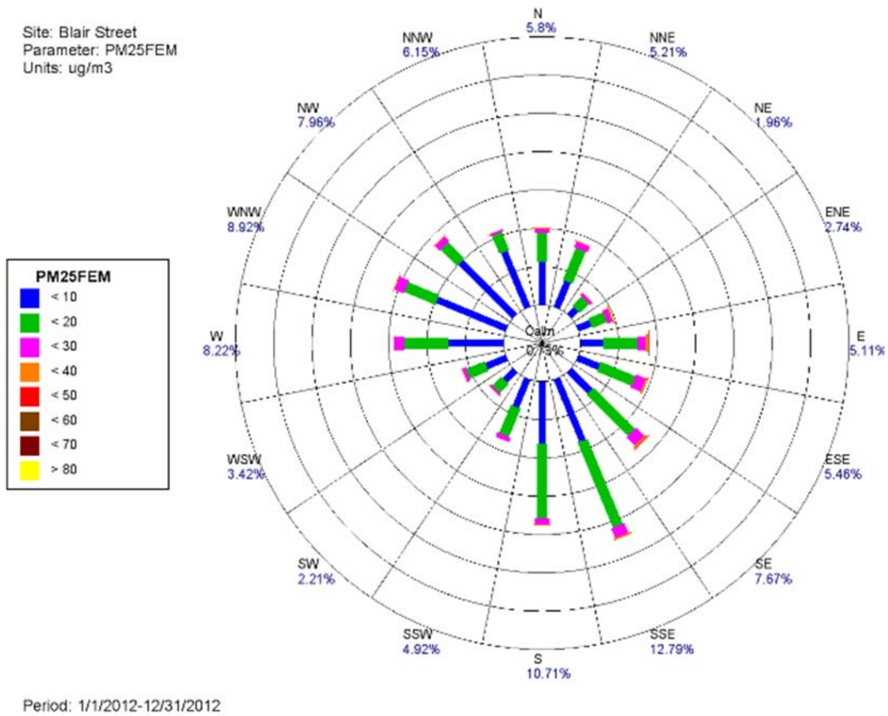
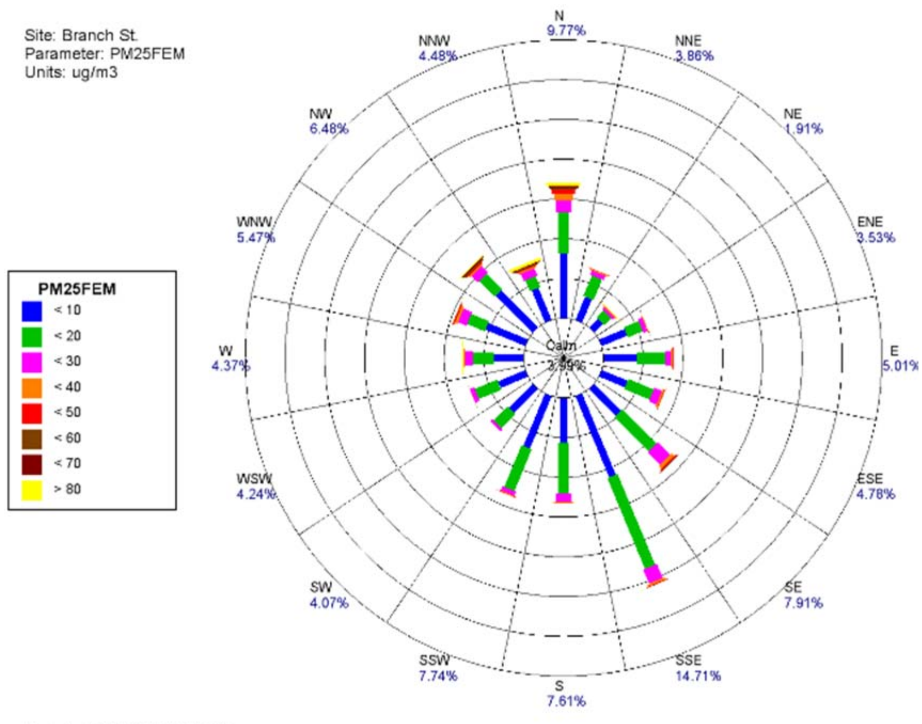

1/1/2012-6/5/2013 PM2.5 Continuous Monitors, average by time of day
18
16
14
12
10
8
6
4
2
0
µg/m3
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
hour (CST)
Steep emmision reductions potentially due to lunch hour
Potential start of Shift (sources near Branch St.)
Potential end of Shift (sources near Branch St.)
East St. Louis
Blair St.
Branch St.

Figure 3



Site: Blair Street
Parameter: PM25FEM
Units: ug/m3
N 5.8%
NNE 5.21%
NE 1.96%
ENE 2.74%
E 5.11%
ESE 5.46%
SE 7.67%
SSE 12.79%
S 10.71%
SSW 4.92%
SW 2.21%
WSW 3.42%
W 8.22%
WNW 8.92%
NW 7.96%
NNW 6.15%
Calm
PM25FEM
< 10
< 20
< 30
< 40
< 50
< 60
< 70
> 80
Period: 1/1/2012-12/31/2012



Site: Branch St.
Parameter: PM25FEM
Units: ug/m3
N 9.77%
NNE 3.86%
NE 1.91%
ENE 3.53%
E 5.01%
ESE 4.78%
SE 7.91%
SSE 14.71%
S 7.61%
SSW 7.74%
SW 4.07%
WSW 4.24%
W 4.37%
WNW 5.47%
NW 6.48%
NNW 4.48%
Calm
PM25FEM
< 10
< 20
< 30
< 40
< 50
< 60
< 70
> 80
Period: 1/1/2012-12/31/2012

The Missouri Air Conservation Commission **ADOPTS** the following action on this 5th day of December, 2013:

Missouri's Recommendation for Area Boundary Designations for the 2012 Annual Fine Particulate Matter National Ambient Air Quality Standard

Jack C Baker, Chairman

______________________________, Vice Chairman

______________________________, Member

______________________________, Member

______________________________, Member

______________________________, Member

______________________________, Member

The Missouri Air Conservation Commission **ADOPTS** the following action on this 5th day of December, 2013:

Missouri's Recommendation for Area Boundary Designations for the 2012 Annual Fine Particulate Matter National Ambient Air Quality Standard

________________________________, Chairman

________________________________, Vice Chairman

________________________________, Member

________________________________, Member

SIGN HERE

________________________________, Member

________________________________, Member

________________________________, Member

Bechtel, Cheri

From: Missouri DNR <MODNR@public.govdelivery.com>
Sent: Monday, October 21, 2013 3:53 PM
To: Bungart, Renee; Archer, Larry; Beydler, Van; Lovejoy, Victoria; Moore, Kyra; Vit, Wendy; Bechtel, Cheri; Crawford, Betsy; Deidrick, Steph
Subject: Courtesy Copy: MISSOURI AIR CONSERVATION COMMISSION PUBLIC HEARING-Rescheduled to 11/21/13

This is a courtesy copy of an email bulletin sent by Cheri Bechtel.

This bulletin was sent to the following groups of people:

Subscribers of Air Public Notices (512 recipients)

Missouri Department of
Natural Resources

Having trouble viewing this email? [View it as a Web page](#).

SHARE

MISSOURI AIR CONSERVATION COMMISSION
WILL HOLD PUBLIC HEARING

JEFFERSON CITY, MO -- The Missouri Air Conservation Commission will hold a public hearing on Thursday, November 21, 2013 beginning at 9 a.m. at the Elm Street Conference Center, 1730 East Elm Street, Lower Level, Bennett Springs Conference Room, Jefferson City, Missouri. The commission will hear testimony related to the following proposed action(s):

* Missouri's Recommendation for Area Boundary Designations for the 2012 Annual Fine Particulate Matter National Ambient Air Quality Standard

On December 14, 2012, the U.S. Environmental Protection Agency (EPA) promulgated a revision to the National Ambient Air Quality Standard (NAAQS) for fine particulate matter ($PM_{2.5}$). The new primary annual $PM_{2.5}$ NAAQS was set at 12.0 µg/m3. The 24-hour primary and secondary standards for $PM_{2.5}$ and the secondary annual standard for $PM_{2.5}$ were unchanged. When a NAAQS is revised, each state is required to submit boundary designation recommendations to EPA for their state within one year after the new NAAQS is promulgated. Areas with ambient air monitoring data violating the standard and nearby areas that contribute to such violations should be designated nonattainment. All other areas should be designated attainment/unclassifiable. Based on technical evaluation of emissions data, weather patterns, and other information, the Air Program recommends for the 2012 annual $PM_{2.5}$ NAAQS a designation of attainment/unclassifiable for the entire State of Missouri.

Documents for the above item(s) will be available for review at the Missouri Department of Natural Resources, Air Pollution Control Program, 1659 Elm Street, Jefferson City, (573) 751-4817 and in the Public Notices section of the program web site http://dnr.mo.gov/env/apcp/public-notices.htm. This information will

be available at least 30 days prior to the public hearing date.

The Department will accept written or email comments for the record until 5 p.m. on November 29, 2013. Please send written comments to Chief, Air Quality Planning Section, Air Pollution Control Program, P.O. Box 176, Jefferson City, MO 65102-0176. Email comments may be submitted via the program web site noted above. All written and email comments and public hearing testimony will be equally considered.

Citizens wishing to speak at the public hearing should notify the secretary to the Missouri Air Conservation Commission, Missouri Department of Natural Resources, Air Pollution Control Program, P.O. Box 176, Jefferson City, Missouri 65102-0176, or telephone (573) 526-3420. The Department requests persons intending to give verbal presentations also provide a written copy of their testimony to the commission secretary at the time of the public hearing.

Persons with disabilities requiring special services or accommodations to attend the meeting can make arrangements by calling the Program directly at (573) 751-4817, the Division of Environmental Quality's toll free number at (800) 361-4827, or by writing two weeks in advance of the meeting to: Missouri Department of Natural Resources, Air Conservation Commission Secretary, P.O. Box 176, Jefferson City, MO 65102. Hearing impaired persons may contact the program through Relay Missouri, (800) 735-2966.

Jay Nixon, Governor
Sara Parker Pauley, Director

Air Pollution Control Program

State Plan Actions

On Public Notice | Proposed for Adoption

On Public Notice

Missouri's Recommendation for Area Boundary Designations for the 2012 Annual Fine Particulate Matter National Ambient Air Quality Standard -

On December 14, 2012, the U.S. Environmental Protection Agency (EPA) promulgated a revision to the National Ambient Air Quality Standard (NAAQS) for fine particulate matter (PM2.5). The new primary Annual PM2.5 NAAQS was set at 12.0 µg/m3. The 24-hour primary and secondary standards for PM2.5 and the secondary annual standard for PM2.5 were unchanged. Pursuant to section 107(d) of the Clean Air Act, when a NAAQS is revised, each state is required to submit boundary designation recommendations to EPA for their state within one year after the new NAAQS is promulgated. Areas with ambient air monitoring data violating the standard and nearby areas that contribute to such violations should be designated nonattainment. All other areas should be designated attainment/unclassifiable. Based on technical evaluation of air quality data, emissions data, meteorological data, and other information, the Air Program recommends for the 2012 annual PM2.5 NAAQS a designation of attainment/unclassifiable for the entire State of Missouri.

A public hearing is scheduled for these proposed boundary recommendations on Nov. 21. Comments about these boundary recommendations will be accepted through the close of business on Nov. 29.

Missouri's Recommendation for Area Boundary Designations for the 2012 Annual Fine Particulate Matter National Ambient Air Quality Standard
Appendix A
Appendix B
Appendix C

Submit Comments

Proposed for Adoption

Clean Air Act Section 111(d)/129 State Plan Revision — Section 111(d)/129 State Plan for Implementation of the Commercial and Industrial Solid Waste Incinerator Emission Guidelines for Missouri

Pursuant to sections 111(d) and 129 of the Clean Air Act, this plan was developed to demonstrate that the State of Missouri has the legal authority and enforceable mechanism in place to implement and enforce the Emission Guidelines and Compliance Times as set forth by the EPA in 40 CFR 60, Subpart DDDD for existing Commercial and Industrial Solid Waste Incinerators. The plan references legal authority established in chapter 536 of the Revised Statutes of Missouri (RSMo) and the enforceable mechanism provided by the proposed new state rule, 10 CSR 10-6.161 Commercial and Industrial Solid Waste Incinerators. This plan provides source and emission inventories of affected existing commercial and industrial solid waste incinerators in the state. It also establishes emission limits, operating requirements and compliance times that are consistent with the federal emission guidelines as promulgated.

A public hearing for this plan action was held on Sept. 26, 2013. Comments about this plan action were accepted through the close of business on Oct. 3, 2013.

Section 111(d)/129 State Plan for Implementation of the Commercial and Industrial Solid Waste Incinerator Emission Guidelines for Missouri

Back to top

DEPARTMENT OF NATURAL RESOURCES

STATE OF MISSOURI

AIR CONSERVATION COMMISSION

In re: Missouri's Recommendation for Area Boundary Designations for the 2012 Annual Fine Particulate Matter National Ambient Air Quality Standard

Public Hearing

November 21, 2013

DEPARTMENT OF NATURAL RESOURCES
STATE OF MISSOURI

AIR CONSERVATION COMMISSION

In re: Missouri's Recommendation for Area Boundary Designations for the 2012 Annual Fine Particulate Matter National Ambient Air Quality Standard

Public Hearing

Department of Natural Resources
1730 East Elm Street
Jefferson City, Missouri

November 21, 2013

BEFORE: Jack Baker, Chairman
Gary Pendergrass, Vice Chairman
David Zimmerman, Commissioner
Mark Garnett, Commissioner

REPORTED BY:
KELLENE K. FEDDERSEN, RPR, CSR, CCR
Missouri CCR No. 838
Midwest Litigation Services
3432 West Truman Boulevard, Suite 207
Jefferson City, MO 65109
(573)636-7551

air pollution control agencies, Illinois, Kansas and other surrounding states and the U.S. Environmental Protection Agency of this public hearing.

Chairman, this concludes my testimony.

VICE CHAIRMAN PENDERGRASS: Thank you. Mark Leath.

MARK LEATH, being sworn, testified as follows:

MR. LEATH: Mr. Chairman, members of the Commission, my name is Mark Leath. I'm employed as an environmental engineer with the Missouri Department of Natural Resources' Air Pollution Control Program. I work at 1659 East Elm Street, Jefferson City, Missouri.

I am here today to present testimony for Missouri's Recommendation for Area Boundary Designations for the 2012 Annual Fine Particulate Matter, or PM2.5, National Ambient Air Quality Standard, or NAAQS. The Department's proposal is to recommend all Missouri counties as attainment/ unclassifiable based on the weight of evidence evaluation we performed. A summary of the recommendation starts on page 99 of the briefing document.

COMMENTS AND RESPONSES ON
AND
RECOMMENDATION FOR ADOPTION

PROPOSED MISSOURI'S RECOMMENDATION FOR
AREA BOUNDARY DESIGNATIONS FOR THE
2012 ANNUAL FINE PARTICULATE MATTER
NATIONAL AMBIENT AIR QUALITY STANDARD

On November 21, 2013, the Missouri Air Conservation Commission held a public hearing concerning Missouri's Recommendation for Area Boundary Designations for the 2012 Annual Fine Particulate Matter ($PM_{2.5}$) National Ambient Air Quality Standard (NAAQS). Based on a technical evaluation of emissions data, weather patterns, and other information, the Missouri Department of Natural Resources' Air Pollution Control Program (Air Program) recommends the entire State of Missouri be designated attainment/unclassifiable for 2012 annual $PM_{2.5}$ NAAQS. The following is a summary of comments received before the printing of this briefing document and the Air Program's corresponding responses. If the Air Program receives additional comments before the end of the comment period on November 29, 2013, a summary of the additional comments received and the Air Program's corresponding responses will be included as an addendum to this briefing document at the December 5, 2013 Missouri Air Conservation Commission meeting.

The document has not been reprinted in the briefing document due to its volume. The entire document is available for review at the Missouri Department of Natural Resources' Air Pollution Control Program, 1659 East Elm Street, Jefferson City, Missouri, 65101, (573)751-4817. It is also available online at http://dnr.mo.gov/env/apcp/stateplanrevisions.htm.

The Air Program recommends the commission adopt the boundary recommendation as proposed. If the commission adopts this recommendation, it will be the Air Program's intention to submit this recommendation to the U.S. Environmental Protection Agency (EPA).

SUMMARY OF COMMENTS: At the time this briefing document was printed, the Air Program had received one (1) comment from EPA.

COMMENT #1: EPA commented that they have reviewed our recommendation and will take the information into account when determining the final designations by December 2014. They stated that Missouri must provide clear technical support demonstrating that Missouri sources are not impacting the violating monitor in Illinois and that they do not consider the technical justification provided in our recommendations to provide conclusive evidence that Missouri sources are not impacting the violating monitor in Illinois. They expressed their intention to continue to work with Missouri throughout the designation process. They also stated that if they determine that modifications to our recommendations may be necessary, they will inform the state through the 120-day letter process as outlined in the Clean Air Act and provide the state an opportunity to respond to any modifications prior to finalization of the designations. They also expressed appreciation to the Air Program for sharing early drafts of the technical analyses with EPA.

RESPONSE: The Air Program would like to recognize EPA Region 7 for their valuable assistance in reviewing early drafts and providing comments on the technical analyses supporting this boundary recommendation. Based on air quality data from 2010-2012, no monitors in Missouri are violating the newly revised $PM_{2.5}$ standard, including four monitors located in the St. Louis metropolitan statistical area (MSA). Because the Clean Air Act defines "nonattainment area" as encompassing a NAAQS violation as well as nearby sources that contribute to the violation, our boundary recommendation effort concentrated on determining the contribution of Missouri sources to any violating monitors in surrounding states. There are two violating monitors in the Illinois portion of the St. Louis MSA, one in East St. Louis and the other in Granite City.

Based on recent air monitoring data and trends, the monitor located in East St. Louis, Illinois is expected to attain the 2012 annual $PM_{2.5}$ NAAQS after monitoring data for 2013 is available, in which case any contribution analysis on the $PM_{2.5}$ concentrations recorded at this monitor would no longer be necessary. Therefore, this response focuses on the violation in Granite City, Illinois.

The Air Program emphasizes that EPA's April 2013 guidance for area designations for the 2012 annual $PM_{2.5}$ NAAQS was followed when developing the technical analyses in support of this recommendation. The guidance indicates there is no presumptive nonattainment boundary and directs states to perform weight of evidence analyses to determine appropriate boundaries. The guidance also provides no clear definition of "nearby sources that contribute to the violation." Key passages from the guidance are highlighted below.

From page 5 of the guidance:

> *Although the CBSA or CSA, as appropriate, is the starting point for the EPA's evaluation of contribution, the EPA does not intend it to be a presumed nonattainment area boundary…*
> *the EPA believes that the weight of evidence approach to determining area boundaries for initial nonattainment area decisions could, under proper circumstances, result in a nonattainment area consisting of single counties or partial counties.*

From page 11 of the guidance:

> *the EPA is not setting a threshold contribution level or bright line test for determining whether an area should be included within the boundaries of a given nonattainment area…*
> *the EPA believes that the contribution determination should be made through a case-by-case evaluation of the relevant factors and circumstances in each nonattainment area.*

From page 14 of the guidance:

> *Finally, all of the above assessments must be aggregated or synthesized into a consistent narrative that describes the relationship between sources in the analysis area and the*

measured violation. This synthesis should represent a collective "weight of evidence" regarding the most appropriate boundaries for the nonattainment area.

Because there is no presumptive nonattainment boundary and no bright line test for determining whether an area should be included in a nonattainment area, determinations for nonattainment area boundaries should be based on a weight of evidence approach. The Air Program's interpretation of this guidance is that, in order to be excluded from a nonattainment area boundary, it is not necessary to demonstrate that Missouri sources have zero contribution to a violation. Instead, a weight of evidence approach should be used to evaluate the relevant factors and circumstances in the St. Louis area that support the inclusion/exclusion of Missouri areas in the nonattainment area. The Air Program has conducted these analyses and synthesized the information into a narrative identifying the relationship between sources in the immediate area of the violating monitors and the measured violations.

The violating monitor in Granite City is located less than one mile from two major sources of direct $PM_{2.5}$ emissions in Illinois and less than five miles from a compliant monitor on the Missouri side. The Air Program conducted a series of data analyses and determined that the local, Illinois sources are the nearby sources causing the violation at the Illinois monitor. In addition, these analyses demonstrate that Missouri sources in the St. Louis MSA have a minimal or negligible impact on this violating monitor. See Appendix A of the boundary recommendation document for the complete narrative and details of the analyses performed.

There were similarities between this situation and the recent boundary designation process for the 2010 1-hour Sulfur Dioxide (SO_2) NAAQS. In that case, the violating SO_2 monitor was in Kansas City, Missouri, and all monitors located in Kansas were in compliance. Even though two nearby Kansas SO_2 emission sources were impacting the violating Missouri monitor, areas in Kansas were <u>not</u> included in the final Kansas City, Missouri SO_2 nonattainment area. The Air Program's preliminary State Implementation Plan (SIP) modeling shows that these two Kansas SO_2 sources located within 10 km of the area have a combined contribution of nearly 50% of the level of the 1-hour SO_2 NAAQS at receptors in the nonattainment area. In contrast, our weight of evidence evaluation for this $PM_{2.5}$ boundary designation process shows that Missouri sources' combined contribution to the Granite City, Illinois monitor is far less than 50% of the level of the 2012 $PM_{2.5}$ NAAQS. The Clean Air Act definition of "nonattainment area" doesn't change from one NAAQS to another, and we ask that EPA treat these two situations consistently and designate the Missouri side of the St. Louis area attainment for the 2012 $PM_{2.5}$ NAAQS. If this is not the final action, the Air Program would like to understand the criteria EPA uses for determining "nearby sources that contribute to the violation" for nonattainment area boundary purposes and whether these criteria change for different NAAQS designation processes.

The Air Program is confident that our weight of evidence analysis is complete, conclusive and conforms to EPA boundary determination guidance for this NAAQS. Missouri has no violating monitors for this NAAQS, and our analysis demonstrates that Missouri sources in the St. Louis MSA have a minimal impact on the violating monitor in Granite City, Illinois. We stand by our recommendation that the entire State of Missouri be designated attainment/unclassifiable for the 2012 annual $PM_{2.5}$ NAAQS.

We understand that EPA will notify us of any changes to our recommendation and provide an opportunity to respond with additional supporting information through the 120-day letter process. In order for us to respond appropriately to the 120-day letter and make the strongest possible case for the State of Missouri, we request that EPA provide specifics on the Missouri sources they've determined to be contributing and identify the particular data sets they are considering.

The Air Program appreciates EPA's input on early drafts of our recommendation and willingness to continue working with the state throughout the remainder of the boundary designation process.

No changes were made as a result of this comment.

NADCA
North American Die Casting Association

3250 N Arlington Heights Road
Suite 101
Arlington Heights, IL 60004
T: 847.279.0001
F: 847.279.0002

www.diecasting.org
nadca@diecasting.org

November 28, 2013

Ms. Kyra Moore
Director, Air Pollution Control Program
Missouri Dept. of Natural Resources
P.O. Box 176
Jefferson City, MO 65102

RE: 2012 PM2.5 National Ambient Air Quality Standard (NAAQS) – State Nonattainment Designations

Dear Ms. Moore:

On behalf of the North American Die Casting Association ("NADCA" or "Association"); please accept these comments regarding the Missouri's proposed designations for the 2012 PM2.5 National Ambient Air Quality Standard ("NAAQS"). We support the Department of Natural Resources recommendations that all counties receive attainment/unclassifiable status.

NADCA is the sole trade and technical association of the die casting industry, representing members from over 350 companies located in every geographic region of the United States. Die casters manufacture a wide range of non-ferrous castings, from automobile engine and transmission parts to intricate components for computers and medical devices. In the U.S., die casters contribute over $7 billion to the economy annually and provide over 50,000 jobs directly and indirectly.

NADCA and manufacturing groups, representing a broad swath of the industry, objected to the U.S. Environmental Protection Agency (U.S. EPA) actions, believing the NAAQS PM rulemaking is "arbitrary and capricious" and unlikely to achieve its stated benefits. As the State defends its attainment area designations under NAAQS, we ask that policymakers take into account the affect these decisions will have on local, regional, and state-wide economies.

Since the establishment of the 15 µg/m3 standard, data shows risks from PM2.5 exposure have declined, while the 24-hour "supplementary" protection standard continues to provide protection to children and other sensitive subpopulations. For example, as you know, scientific data demonstrates a decade-long downward trend in PM2.5 concentrations in the St. Louis area. This decline is expected to continue due to effective control measures that are already in place. Although it is the U.S. EPA setting the new standards, the Clean Air Act gives states and local governments the "primary responsibility" to prevent and control air pollution. This is why a state's determination of attainment vs. nonattainment is so fundamental to the future of manufacturing in the local community.

All Missouri manufacturers, including NADCA members, provide over 247,400 jobs at roughly 6,387 facilities in the State. These employees, their families, and supporting businesses will see a significant impact on their operations whether or not they work in an attainment or nonattainment area. While either designation carries with it significant economic burdens and disputed public health benefits, nonattainment status can cripple the local manufacturing community.

Regardless of their merit, regulations that go beyond this standard will add unnecessary cost and complexity without furthering the goals that Congress set forth in the Clean Air Act. For this reason and those stated below, NADCA asks that the federal policymakers closely consider the impact a nonattainment designation will have on local manufacturing businesses, their employees, and the ability to expand production while adding jobs.

An April 2013 survey conducted by NADCA found that of all respondents, 66% have job openings and 95% face severe or moderate challenges recruiting qualified employees to fill those positions. Nationwide, manufacturers have 600,000 skilled job openings according to a study by Deloitte and the Manufacturing Institute. This shocking data clearly indicates manufacturing in America is expanding and employers in Missouri are ready to hire more people and increase production at their facilities. However, should the U.S. EPA designate certain areas as nonattainment zones; manufacturers will face numerous obstacles to expanding their operations and hiring more employees.

As you know, Missouri manufacturers are not only competing with businesses in neighboring states such as Iowa, Kansas, and Illinois, but also against foreign businesses who do not face the same restrictions as U.S. manufacturers. The NAAQS PM2.5 regulations are far more stringent than standards in other industrialized nations. For example, European Union annual PM2.5 standard is 25 µg/m3 and set an average exposure indicator ("AEI") reduced to 18 µg/m3 by 2020. Japan, a major competitor for U.S. automotive suppliers, applies an annual PM2.5 standard of 15 µg/m3. The Manufacturers Alliance for Productivity and Innovation (MAPI) states that U.S. manufacturers face a 20% competitive disadvantage against foreign competitors. The arbitrary and capricious standards set under NAAQS PM will place American manufacturers even further behind overseas companies.

A Roadblock to Growing Jobs and Businesses

The State of Missouri can control much of its own economic destiny in its recommendation to designate all counties as attainment/unclassifiable. As you know, should the EPA not support your recommendation, whether in the Kansas City or St. Louis metro regions or another area, a series of additional requirements will apply to businesses located within the zone. When it comes to attracting new businesses to the State and opening new manufacturing facilities, this will have a significant negative impact. NADCA believes that state governments should do all they can to foster an environment which encourages manufacturing in America, not erect self-imposed barriers.

A nonattainment designation for an area under 40 CFR part 81, subpart C places multiple stringent conditions on businesses before the company may be allowed to construct or modify an existing facility. The goal is to control the source's total emissions, either by requiring emission offsets from existing sources to counteract the new emissions or the installation of pollution control equipment.

Die casters like NADCA members are in an even more unique situation. The structure of a typical die casting machine does not allow for an emissions capture apparatus in a cost effective manner nor in a way which will likely achieve the stated goals under NAAQS. Regardless of the technical feasibility of additional controls, a January 2003 study of the die casting industry showed an "analysis of samples taken from a die cast machine suggest very little if any residue is exhausted out into the environment."

The greatest concern to NADCA members and manufacturers is the potential requirement that a manufacturer cap production at a certain level in order to meet national air quality standards. What this means to a typical manufacturer is that they cannot hire more employees, purchase new equipment, or expand their existing facilities – all of which are essential to local, regional, and national economic growth. At a time when the country is slowly emerging from the Great Recession, policymakers, whether

in Washington or state capitals, should find ways to support these employers, especially when current policy is already working.

In a 2012 MIT study titled, “The Effects of Environmental Regulation on the Competitiveness of U.S. Manufacturing,” researcher found that there is a direct connection between a decline in manufacturing productivity and companies located in a nonattainment area. According to the report, “this corresponds to an annual economic cost from the regulation of manufacturing plants of roughly $21 billion in 2010 dollars.”

<u>Establishing Boundaries – Picking Winners and Losers</u>
Among the most consequential decisions a state can make is determining the boundaries for a nonattainment area. Per federal guidelines, even if a community is outside the primary subject zone, a state may include that region in the nonattainment area if the government determines it contributes pollution to a nonattainment zone. Policymakers should not assume primary and secondary attainment areas are the same for designation purposes. This assumption would unnecessarily restrict manufacturing growth.

Among the greatest threats to domestic manufacturing is a state establishing a larger nonattainment area than originally prescribed. Federal guidelines also make it more difficult for local communities with a significant manufacturing presence to meet national air quality standards on their own. We believe both the state and public are better served in this instance with an “unclassified” designation which will preserve jobs and allow businesses to compete more fairly.

The State has more than one metropolitan area which regulators can classify as “urban concentration”. As with any major city, vehicle miles traveled and mobile sources of emissions contribute to ozone and PM2.5 release more than in a rural community. Emissions from non-stationary sources released in a certain region can unfairly lead to a nonattainment classification for this community. These mobile sources can result in to restrictions placed on local businesses who will struggle to attract new employees and employers to the region. State designations will lead to arbitrary boundaries drawn, leaving government officials to decide the winners and losers.

Take for example the St. Louis metropolitan area. The State of Missouri analyzed the impact of additional controls in that region. The State concluded that,

> “Even if areas in Missouri were to be included in a nonattainment area as a result of the violating monitors in the Illinois portion of the St. Louis MSA, few if any new controls in Missouri…would actually be required for the area. This means there would be no net air quality benefit by designating areas in Missouri nonattainment based on these violating monitors.”

Accordingly, should even the State of Illinois designate their portion of the St. Louis metropolitan region as a nonattainment area; it will unduly place manufacturers in the entire metro area in both states at a significant disadvantage. This will ultimately lead to more manufacturers leaving region for other areas and states which discourages new businesses from investing and opening factories in Missouri.

Economic activity comes with mobile emissions which count against the local community under NAAQS. As a result, it is this local community who will suffer under a nonattainment designation even though their manufacturers are not responsible for the released emissions. Essentially, this punishes businesses purely based on happenstance and activities completely out of their control. This is yet another reason that if a county attains the secondary NAAQS, the state should designate that area as “attainment”. Any other designation would artificially expand the primary zone and unnecessarily capture other locations subjecting them to needless restrictions.

Use of Flawed and Incomplete Data

The EPA guidelines call on states to use data from the preceding three years or 2010-2012. This date range will include the surge in manufacturing which resulted from manufacturers and consumers rebounding from the Great Recession. In the early recovery period, manufacturers ramped up production to meet pent up demand. The inclusion on this high-production period may produce skewed results.

More consequential however is the use of monitoring data over modeling predictions which typically overestimate ambient concentrations. The use of modeling may lead to an incorrect designation which could cripple the local manufacturing community. The states should not go beyond the criteria set forth under the Clean Air Act and adopt additional methods which could unduly restrict the flexibility provided by the federal government.

The selective use of data and targeting the maximum levels rather than ambient air conditions will lead to incorrect findings. While the EPA rule contains significant technical flaws rendering it arbitrary and capricious, under the Clean Air Act it is ultimately the states that have primary responsibility to prevent and control air pollution.

Conclusion

The State of Missouri, under the Clean Air Act, has the opportunity to control its own economic destiny and the success of its manufacturers. Therefore, NADCA supports the Missouri Department of Natural Resources recommendations to designate all counties as attainment/unclassifiable.

Government officials from President Obama to local representatives recognize that manufacturing is the engine driving the country out from the Great Recession. At a time when manufacturers are driving the economic recovery, policymakers should not erect new barriers to restricting job creation.

Thank you for your consideration of these comments and we look forward to working with you to strengthen manufacturing in America.

Sincerely

Daniel Twarog
President
North American Die Casting Association